



# OPTO JUMP next

## User Manual

Version 1.3

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# 1 INTRODUCTION

OptoJump Next is an innovative system of analysis and measurement that brings a new philosophy of performance assessment and optimization to the world of competitive sport. By acquiring the fundamental parameters that characterize the level of an individual's performance and physical condition, OptoJump Next allows coaches, trainers and researchers to constantly test and monitor their athletes. This makes it possible to ascertain the abilities or physical fitness of an athlete in a simple and instantaneous way, creating even over a period of time a database that allows to compare values for that athlete or different athletes (even at a distance of months or years).

## 1.1 QUICK START: ONLINE VIDEO TUTORIAL

For a brief introduction to the software for OptoJump Next, we strongly recommend you to watch the introductory webcast available on the official site:

<http://www.optojump.com/support/software-tutorial.aspx>

In about ten minutes all the software modules will be illustrated and after watching it you will be able to perform the most common operations, which can be summarized as follows:

- Graphic and surfing interface
- Checking of general parameters
- Checking of status of bars and webcams
- Insertion of athletes' data
- Performance of tests
- Viewing results
- Comparison of tests and statistics
- Printing and exporting of data to other programs

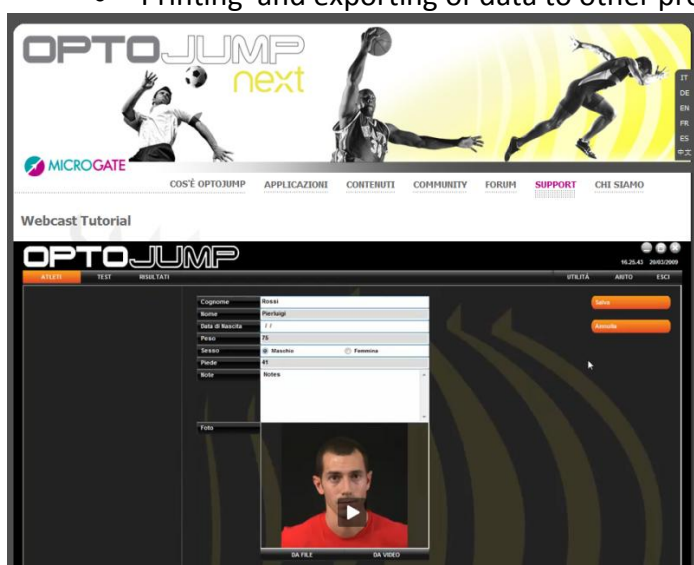


Figure 1 – Webcast Tutorial

## 2 SOFTWARE INSTALLATION

Start the OptojumpNext.exe. setup program in the usual way for Windows.

In the first installation window the user is asked where to save the files for the installation of OptoJump Next. We advise you to leave the directory unchanged and to click on <Next> to continue.

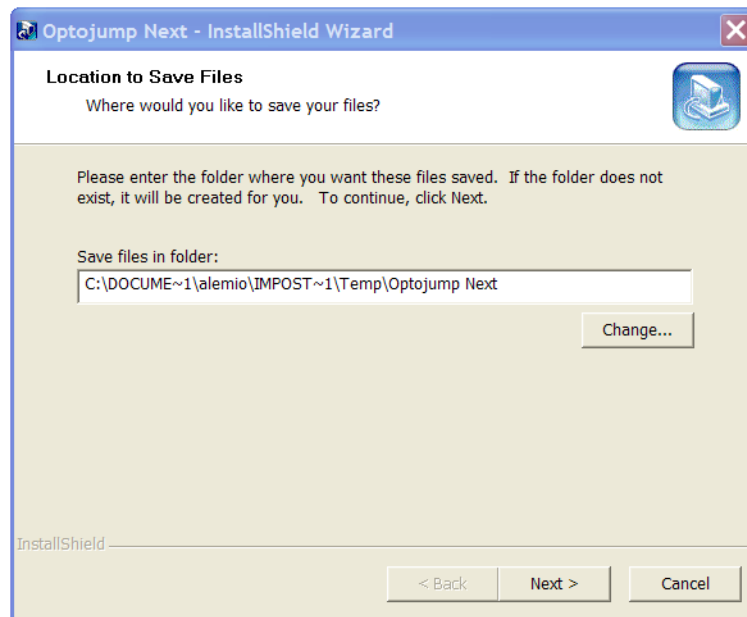


Figure 2 – Installation wizard

In the first installation program window click on <Next>.

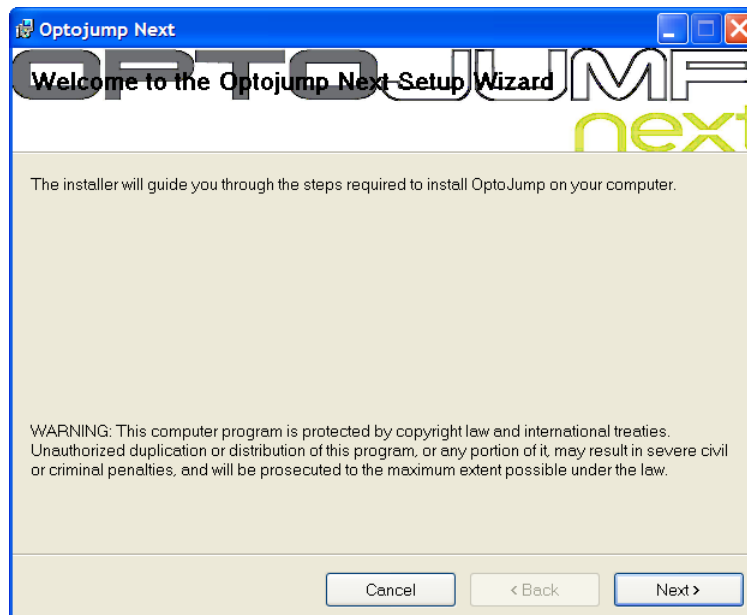


Figure 3 – Installation - welcome.

In the next window you can insert a folder where the software will be installed.

If you want everyone with access to the computer to be able to use the product, select “Everyone”, otherwise select “Just me”.

We advise you to leave the folder unchanged and select “Everyone”. Click on <Next> to continue.

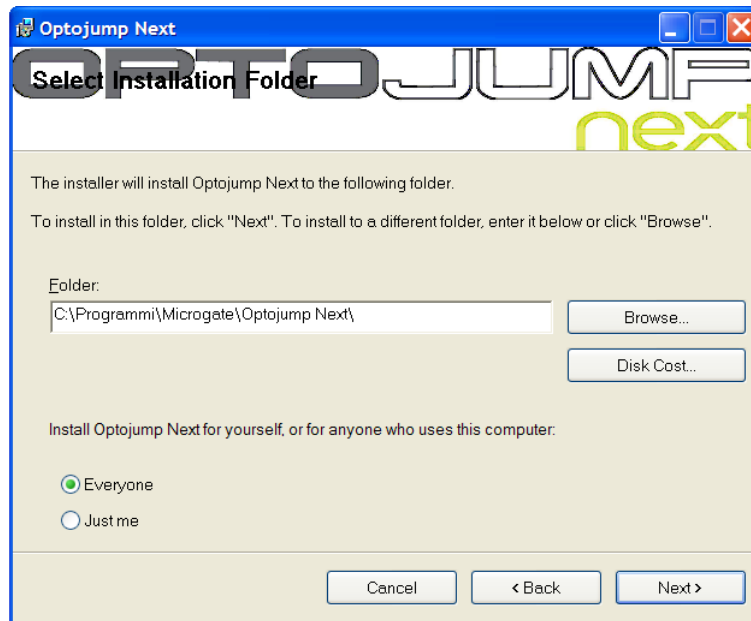


Figure 4 – Installation – data insertion.

The next window offers to launch software installation. If all the data is correct, click on <Next>.

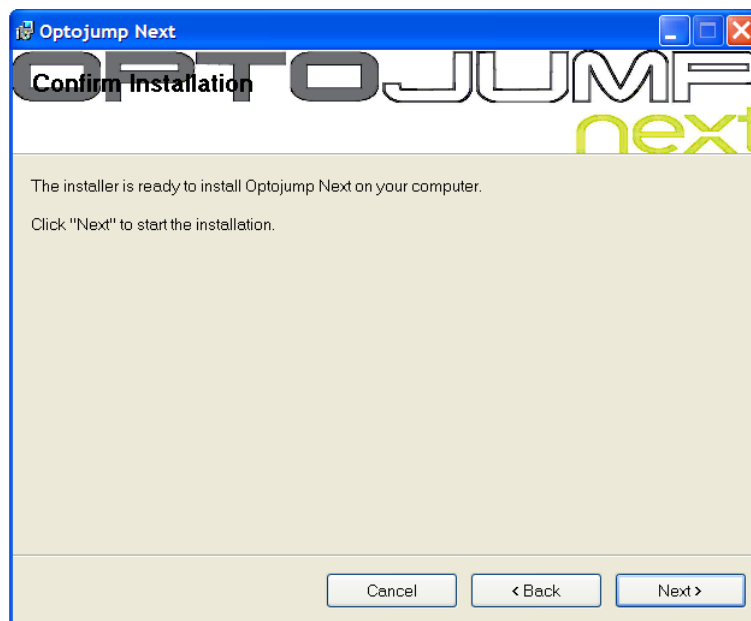


Figure 5 – Installation – confirm installation

The setup program will install the product on the PC, showing state of progress.

During installation the OptoJump Next and Logitech webcam drivers will also be installed.

If for any reason this does not happen, please install the drivers separately. These are available on the Microgate USB key supplied with the hardware or on the site [www.optojump.it](http://www.optojump.it) in the Support section.

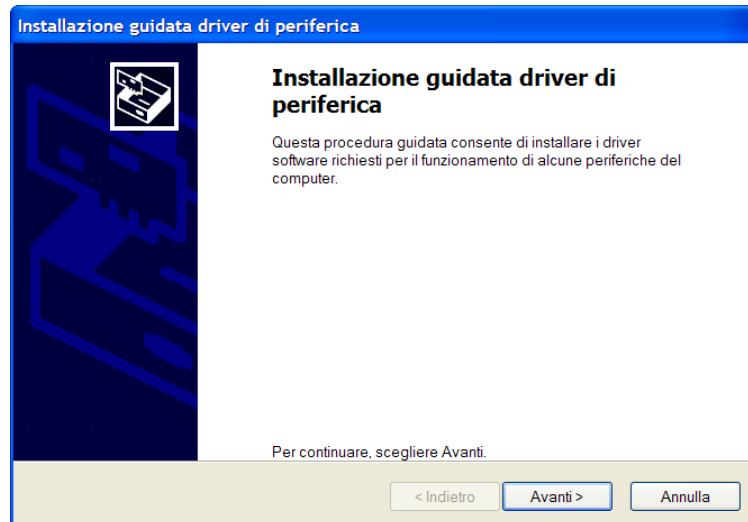


Figure 6 – Driver Installation

Press <Next> to install the drivers and then <Finish> to complete installation.

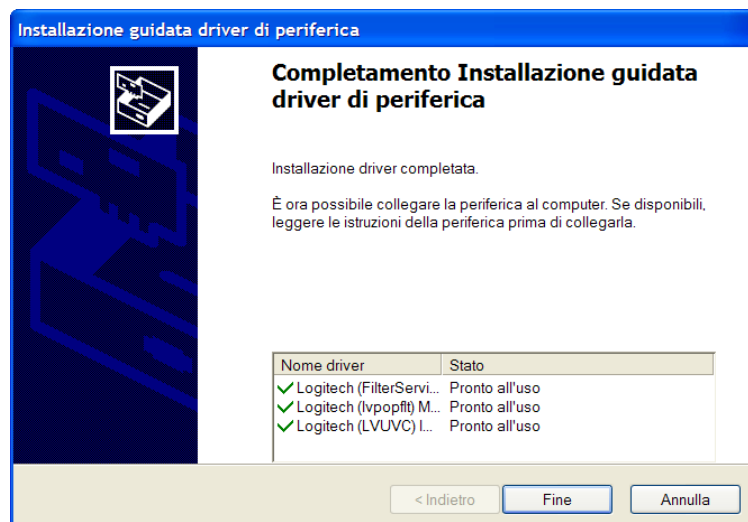
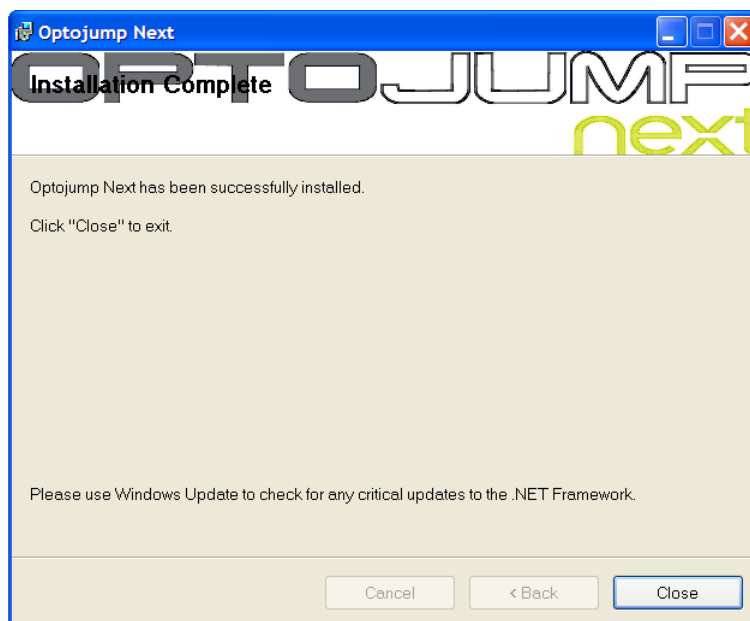


Figure 7 – End of driver installation



*Figure 8 – Installation – completed.*

By clicking on <Close> you exit the installation procedure.

During the entire installation procedure, it is possible to return to the previous window by clicking on <Back>.



### 3 DESCRIPTION

The welcome screen of the OptoJump Next software shows a horizontal bar with the most important menu items and an area with News and Events, which are automatically updated from the web site [www.optojump.com](http://www.optojump.com) in the appropriate language. In case of missing Internet connection, the information will not be downloaded; it is also possible to deactivate the Internet connection with a configuration parameter (see chap. 5.4.1.7). Click on a news title or an event to open the complete description in a browser window.



Figure 9 – First page

The interface with which the OptoJump Next system is managed is divided into three main sections: Athletes, Tests and Results.

#### 3.1 ATHLETES

In this section the profiles of the athletes or patients are created and catalogued. Each profile can contain many items of information (personal data, notes, athlete's photo, etc.). Membership Groups can be created to improve subdivision into different categories when the tests are to be

performed. For example, a group “Football” can be created with its subgroups ‘Attackers’, ‘Midfielders’ and ‘Defenders’.

## 3.2 TEST

This section is the software’s nerve centre. It is accessed to devise and configure new tests (jump, reaction, running, etc.) and to perform tests by choosing from the pre-defined tests or those created by the user. It is then possible to program sequences of tests in order to make one or more athletes perform a number of tests.

During performance the user sees the evolution of the test in real time by means of numerical, graphical and video data. This data can be saved and stored for immediate review or future consultation. Depending on the user’s requirements, information not of interest can be temporarily hidden in order to highlight other information. For example, the charts and tables can be hidden to show only the videos in larger size.

## 3.3 RESULTS AND VIDEO ANALYSIS

In this section it is possible at any time to call up previously performed tests. By displaying the results, it is possible to compare the images with the numerical and graphical data. The video images are synchronized with the athletes’ movements. This makes it possible to accurately establish what happened when a certain piece of data was acquired. For example, if a contact time is too long, it is possible to find out why by observing the images at the time that value was recorded.

The speed of the video can be reduced down to ‘frame by frame’ or still picture. There is also a video analysis utility that makes it possible to draw on the still picture, thanks to various graphical tools (lines, arcs, circles, ruler, goniometer, etc.).

In the Results section, it is also possible to compare two or more tests without the assistance of additional software: for example, it is possible to ascertain the performance of an individual over a period of time or compare the results of tests performed by two or more different athletes.

All the data, numerical as well as graphical, can be printed or exported in the most common formats (PDF, Excel, Word and HTML).

## 4 OPTOJUMP NEXT DRIVER AND HARDWARE INSTALLATION

### 4.1 DRIVER INSTALLATION

For correct functioning of the program, the respective drivers for the OptoJump Next hardware and the webcam must be installed.

The OptoJump Next software installation file already contains the required drivers.

In the case of the Vista operating system it has been found that if the installation program is not run as 'Administrator', the drivers are not installed. In this case install the two drivers separately. These are available on the Microgate USB key supplied with the hardware or on the site [www.optojump.com](http://www.optojump.com) in the 'Support' section.

To check that the drivers have in fact been installed, connect the two devices (OptoJump Next hardware and webcam). If installation has not taken place, the operating system will signal an error. In this case disconnect the hardware, install the drivers again and reconnect the hardware.

### 4.2 OPTOJUMP NEXT HARDWARE INSTALLATION

Attention must be paid when installing the OptoJump Next bars, particularly when inserting the caps for connecting the bars.

The distinctions to be made between the bars are between Tx and Rx and additionally between bars with interface (silver drum at start of bar) and without interface. Only the interfaces have an OFF switch.

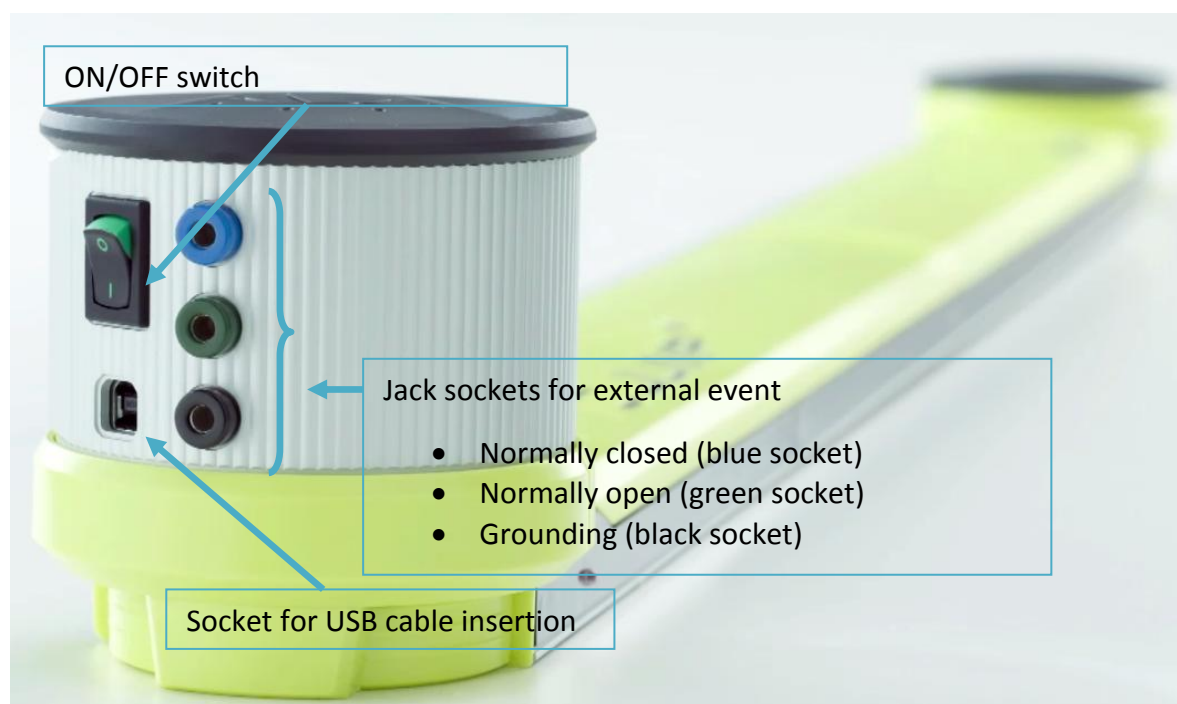
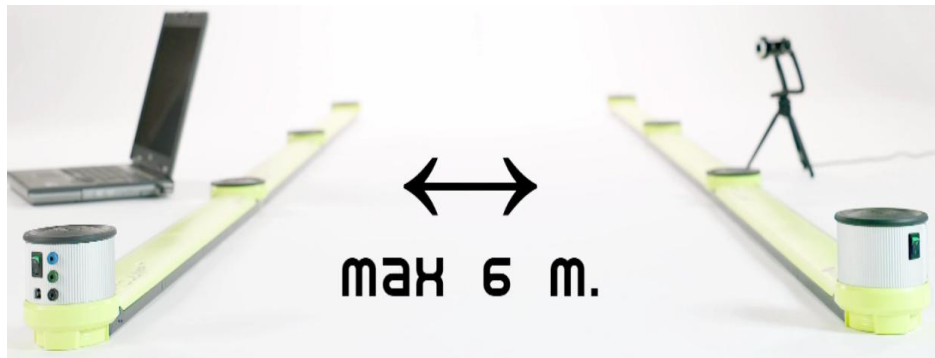


Figure 10 – Bar with interface

Below is the step-by-step procedure for bar installation:

- Switch off the OptoJump Next device
- Place the two OptoJump Rx and Tx bars facing each other at a minimum distance of one meter (maximum 6 meters)



*Figure 11 – Maximum distance*

- If a number of bars connected together are used, pay attention to the insertion of the caps (see figures below). Check that the caps are firmly inserted. If insertion is incorrect, the software may not function correctly.



*Figure 12*



*Figure 13*



*Figure 14*



*Figure 15*

To **mount** the connection cap just insert the cap in the dedicated slots and apply light pressure on both sides until it has been completely inserted (make sure it is parallel with the two bars; the two connectors should slot in simultaneously).

The cap can only be inserted one way round. If you find that the cap will not go in, turn it 180°.

**DO NOT** force if insertion is difficult, as this would risk bending the connection pins!



Figure 16 – Cap mounting



Figure 17 – Inserting with light pressure

To **remove** the cap, grip the two side tabs and pull upwards symmetrically. Alternatively, you can hold one of the 2 bars down firmly and carefully lift the other until the cap comes off.



Figure 18 – Cap removal



Figure 19 – Alternative method for removing the cap




- Connect the USB cable from interface Tx to the computer USB port. The USB port on the computer is marked with the symbol .



Figure 20 - PC connection

- If more than three OptoJump Next meters are used (three Tx bars and three Rx bars), we recommend you use the adaptor
- Switch on the OptoJump Next device
- Check that the bars are correctly positioned (Rx LED green)



Figure 21 – Led indicator

If the software is being installed for the first time or being re-installed, the operating system will load the correct driver (see section above).

At this point the OptoJump device is ready for use.

If other bars are connected, remember to switch the device off and switch it back on.

If you notice that the device is not working correctly, perform an OptoJump Next bars Test (see chap. 5.4.3).

**NB:** Do not mix 10 mm and 30 mm bars. The bars are clearly marked and distinguishable with regard to both resolution (10 and 30) and for TX and RX



Figure 22 - RX bar



Figure 23 - TX bar

## 4.3 POWER SUPPLY

OptoJump Next runs on batteries with a life dependent on the number of bars connected (see Appendix A – OptoJump Next Battery life). The blinking LED next to the adaptor connector shows the battery charge status:

Green-blinking = battery sufficiently charged

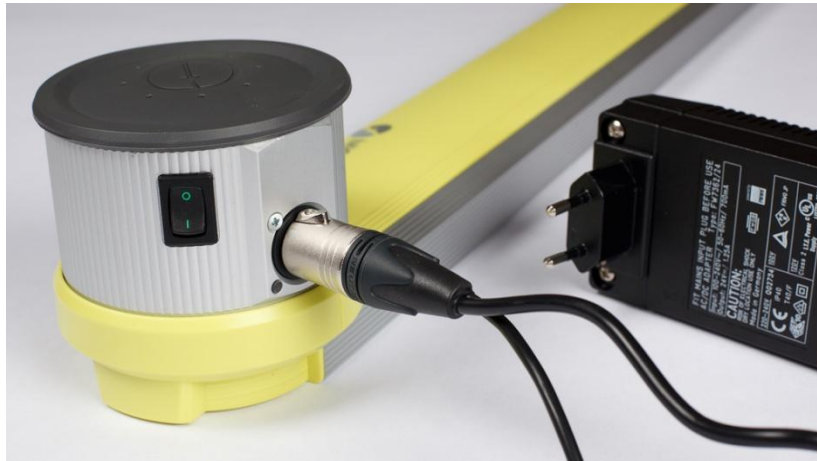
Red-blinking = low battery; the bars must be connected to the mains supply

Orange = battery being recharged



Figure 24- Battery charge status LED

To recharge the battery, connect the adaptor plug to the dedicated socket on the drum.

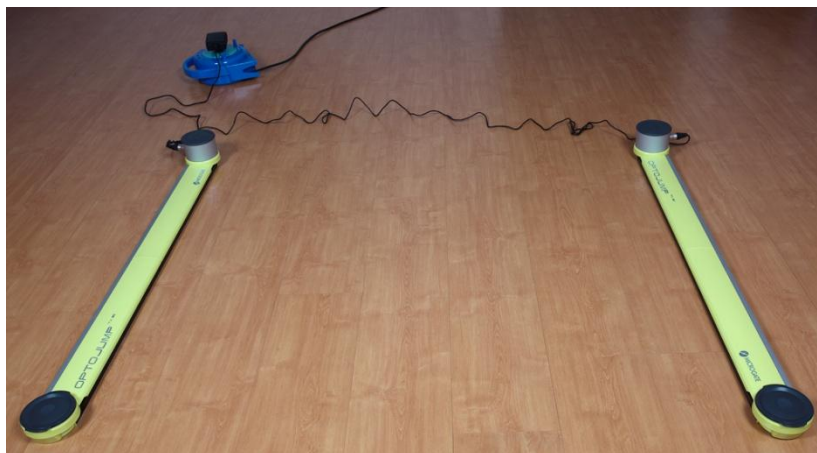


The TX RX bars can be recharged simultaneously using the dedicated cable that connects the second drum to the adaptor.



*Figure 25 - Adaptor and cable for second bar*

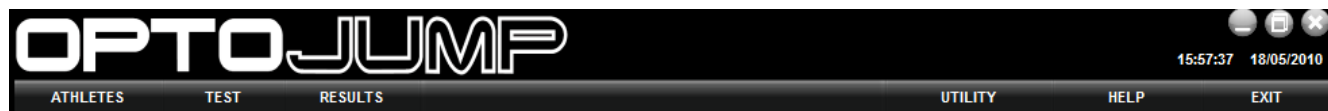
The connection cable is long enough to make it possible to keep the bars at a normal distance (5 - 6 m) and therefore to work normally even when connected to the power supply.



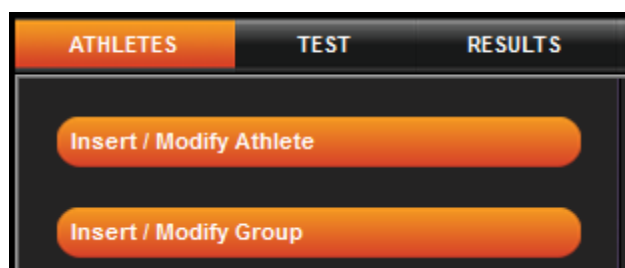


## 5 DESCRIPTION OF FUNCTIONS

In this chapter all the functions of every menu of the OptoJump Next program will be described, starting with the functions of the main menu.



### 5.1 ATHLETES



#### 5.1.1 INSERT / EDIT ATHLETES

In this section all the athletes stored are displayed.



Figure 26 – Edit Athletes

Click on the names of the columns (Last name, Name, Date of Birth) to order the list according to that field; clicking on the same column again reverses the order (A...Z, Z...A).

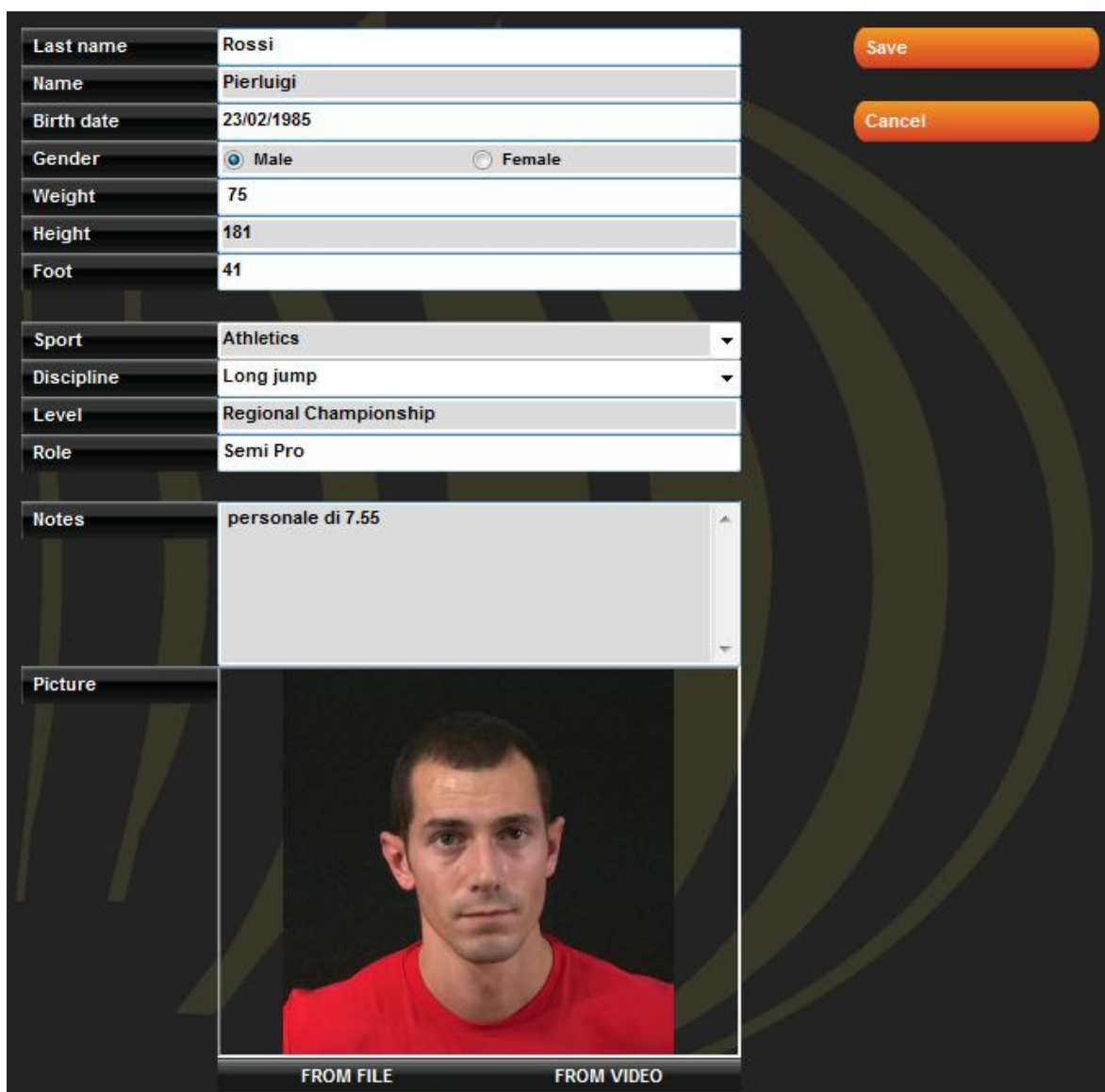
To search for a particular athlete or to filter data (e.g. search for all athletes beginning with “Ros”), insert the text in the box at the top left and press <Search>. To remove the filter press <Delete filter>.



Search interface showing a search box with the text "ros", a "Search" button, and a "Delete filter" button. Below the buttons is a table with three columns: Last name, Name, and Birth date.

Last name	Name	Birth date
Rossi	Pierluigi	2/23/1985
Rossini	Paolo	8/19/1983

Pressing the button <New Athlete> opens a new panel in which the new athlete’s data must be inserted. Last name is the only compulsory field. The weight (given in kg or pounds depending on the unit of measurement chosen in Basic Configuration) is however necessary if you wish to use the tests to determine the value for total power or total energy.



Athlete Data input mask form. Fields include: Last name (Rossi), Name (Pierluigi), Birth date (23/02/1985), Gender (Male selected), Weight (75), Height (181), Foot (41), Sport (Athletics), Discipline (Long jump), Level (Regional Championship), Role (Semi Pro), Notes (personale di 7.55), and Picture (FROM FILE / FROM VIDEO). Save and Cancel buttons are present.

Figure 27 - Athlete Data input mask

Especially for trainers and coaches who have many athletes to assess, the function for associating each athlete with a photo is very useful. This can be taken from a file previously saved on disk (in .jpg or .bmp format), or taken 'on the spot' with a previously connected webcam. In the first case click on <From File> and select the desired photo from a folder; in the second case, click on <From Video>, wait for the Live image to appear, frame the athlete and press <Acquire>.

#### 5.1.1.1 ATHLETE DATA INPUT MASK

To edit the data of a stored athlete, select him/her with the mouse and press <Edit Athlete>: in the Athlete Data mask fields may be edited and saved (or cancelled going back to the list).

Furthermore three buttons allow to view tests, protocols, and analyses of the current athlete (actually a filter is created as explained in section 5.3.1)

The command <Capture foot> measures the foot in cm (i.e. in 'number of LEDs', which are then converted into centimeters or inches according to the unit of measurement used). Click the button, position one foot inside the bars (parallel to them) and click on <Confirm>.

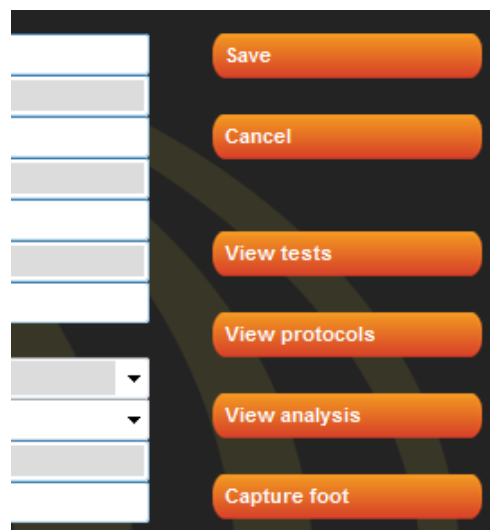


Figure 28– Command in the Edit panel

After a few seconds the measurement is displayed and can be confirmed or in case of doubt repeated.

The measurement (essential for the treadmill tests) is useful only with the 1 cm OptojumpNext version, as the resolution of the 3 cm version is too low to give a reliable value (e.g. depending on how the foot is placed, the measurement can vary from 15 to 18 cm). The value is saved in the database associated with the athlete and is displayed in the mask; the editable field 'foot' is only for personal data and can be used to write the measurement in any unit (e.g. 41 EUR, 7 ½ US, 8 UK, etc.).

In the athletes list the following commands are available. To eliminate him/her, press <Delete Athlete> (WARNING: When deleting an athlete all his/her tests, protocols, and analyses will be deleted without any possibility to restore them).

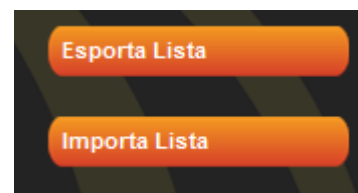
To insert an athlete into a group, select from the list, press <Add to a group>, select the group to insert him/her in (possibly using the right arrow to select a dependent subgroup) and press <Add to a group> again. Press <Back> to return to the athletes' list.

For the management of groups and other ways of associating with groups, we suggest you read the next section.

By pressing <Export>, the athletes' personal data can be exported to a file with the extension 'xml', which can be used with Excel (Excel XP versions 2003 and 2007) or with other programs using this well-known exchange format.

### 5.1.1.2 IMPORTING AND EXPORTING ATHLETES' PERSONAL DATA EXCEL

Once compiled in Optojump Next, the Athletes' Personal Data can be exported into an Excel-compatible format (XML Spreadsheet 2003). Press <Export List> and specify the name and location of the XML file. If you have Microsoft Excel installed on your computer, double-click on the file icon to launch the program and view the columns with all relevant athletes' data.



If you already have an athletes' list created with another software, it can be imported with Optojump Next preparing a normal Excel file with the same

File name:	Anagrafica OJ.xml
Save as type:	XML Spreadsheet 2003 (*.xml)

format as the export file (number, location, column headers and format 'XML Spreadsheet 2003'). It is recommended to export an empty personal data base to create a file template and then to fill it with the desired information. Attention must be paid to the birth date format (DD/MM/YYYY) and the 'Gender' field, which must be 'M' or 'F'. The pre-configured fields 'Sport' and 'Discipline' can only be one of those available from the dropdown menu. Possible errors during the import are listed in a log window at the end of the import (if the error is not blocking, the athlete is added anyway, but with any possible wrong fields empty).

### 5.1.2 INSERT / EDIT GROUP

In this section infinite groups and subgroups can be created, making it easy to manage the athletes' personal data.



Figure 29 – Managing groups

As a default there is always a group called 'Athletes' which is the Parent group of the ones we will subsequently create. All the athletes we insert are automatically added to this group.

To create a subgroup, choose the parent group under which to create it, press <New Group>, key in the name and confirm (e.g. if you want to create 'Team A' as a 2nd level group, select 'Athletes' and press <New Group>, whereas if you want to create a 4th level group under Midfielders, make sure to select it before pressing <New>).

When a group is selected, the grid below will show the athletes belonging to the group chosen and its 'relationship'.

To add one or more athletes to a group there are two possibilities (apart from the one already seen in the previous point which made it possible to add one athlete at a time):

- Select the group to which you want to add an athlete and press <Add to a Group>, select one or more athletes by checking them in the grid and press <Confirm>. It is possible to use <Select All> or <Deselect All> to speed up checking operations. Press <Cancel> to exit this function without adding athletes.
- Select the root group 'Athletes' (which always contains all of them), select one or two athletes by clicking on them (see below) and drag them with the mouse (the classic drag 'n drop function) to the destination group: the message 'Done' will confirm that the operation has been successfully completed. To make multiple selections, use the SHIFT keys to select a range of athletes (from... to...) or the CTRL key for selections that are not adjacent.

Members of Athletes		Members of Athletes	
Last name	Name	Last name	Name
Durand	Pierre	Durand	Pierre
Finesse	Charles	Finesse	Charles
Huber	Franz	Huber	Franz
Rossi	Pierluigi	Rossi	Pierluigi
Rossini	Paolo	Rossini	Paolo
Smith	John	Smith	John
Torres	Felipe	Torres	Felipe

*Selecting a range. Click on 'Finesse', keep SHIFT pressed, click on 'Rossini'*

*Selecting a number of non-adjacent athletes: keep CTRL pressed and click on the athletes*

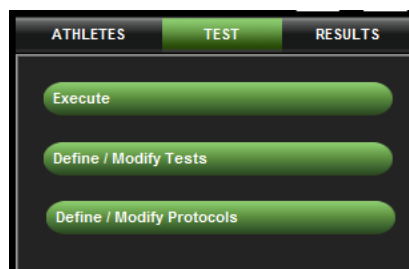
It is also possible to move athletes from one group to another with these two methods:

- Select the source group of an athlete you want to move, select one or more athletes, press <Move into a Group>, select a destination group and press <Confirm move>. Press <Cancel> to cancel the operation in progress.
- Select the subgroup from which to transfer the athlete or athletes and perform the same drag 'n drop operations described above. The difference between operating from the root group "Athletes" or from others is that in the first case the athletes are always copied while they are transferred without copying when moved from one subgroup to another.

With <Delete Group> the group selected and its dependent subgroups are eliminated (but not the athletes that formed it), while with <Edit Group> its name can be changed.

With <Remove from Group> the athlete selected in the grid is removed; the athlete is only removed but not eliminated from the database. The button is disabled when no athlete is selected or when the first level group "Athletes" is displayed.

## 5.2 TEST



### 5.2.1 EXECUTE

In this section the pre-defined tests or protocols are carried out. To define a test or protocol, see the sections below. In addition, before performing a test, at least one athlete must be inserted in the database.



Figure 30 -ExecuteTo perform a trial it is advisable (but not obligatory) to follow the direction of the operations indicated by the red arrow at least the first time you enter this section.

The basic flow is

- select the athlete
- select the test type (using tests or protocols)
- optionally configure some viewing parameters
- press Execute and have the athlete perform the jump test or the running/gait test
- Save, Cancel or Repeat the test



Let's look at an example:

1. Choose one or more athletes by pressing the orange button <Select> under the 'Athletes' box, then tick one or more athletes in the grid and press <Confirm>. Shortcuts are possible using the <Select All> and <Deselect All> buttons, whereas if the athlete database has been organized in groups and subgroups, a group can be selected with <Select Group>.
2. Select one or more tests by pressing the green <Select> button under the 'Test' box; select one of the three test macro-typologies (Performance, Gait Analysis, Rehab) to view the relevant test definitions, then tick one or more tests in the grid and press <Confirm>.
- 2a. As an alternative to the selection of a number of tests, it is possible to select a pre-defined protocol. Click the green <Select> button under the 'Protocols' box, select the macro-typology and click on one of the protocols followed by the <Confirm> button. It is not possible to select more than one protocol at once. When the protocol has been chosen, the test list is compiled with the tests that define the protocol.
3. Check the configuration by pressing <Configure> (see chap. 5.2.1.1 Execute Configuration)
4. Execute the test by pressing <Execute> (or <Repeat> if a test has already been performed)
5. Wait for activation of the Webcam (if installed) and the sound signal that gives the 'all clear' to performance of the chosen test.
6. Follow the instructions at the bottom left which, depending on the test definition, will tell you to 'enter' or 'exit' the test area (i.e. the space between the bars).
7. Save the test performed with <Save>, or watch the video again with <Review> or cancel the test with <Cancel>. Press <Repeat> to have the athlete repeat the test without moving to the next test (or the next athlete). If <Repeat> is pressed before saving, the test will be deleted. Press <Insert Note> to add a note to the test that had just been completed.

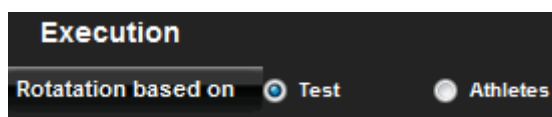


## Test cycle

We have seen that it is possible to select more than one athlete and/or trials (using multiple selections or choosing a protocol, which is simply a pre-defined sequence of pre-defined tests) and therefore have a 'cycle' of tests performed. In this case the ⇐⇒ arrows will appear in the respective boxes for moving around the selected data.

Let's suppose we select two athletes ('Rossi' and 'Smith') and two tests ('Squat jump', 'Stiffness').

Depending on how the parameter 'Rotation based on...' is set, the following types of sequence can be set:



Rotation based on a <b>Test</b>	Rotation based on <b>Athletes</b>
Rossi/Stiffness	Rossi/Stiffness
Rossi/Squat jump	Smith/Stiffness
Smith/Stiffness	Rossi/Squat jump
Smith/Squat jump	Smith/Squat jump

TIP: When athlete, test or protocol selection is made, it is possible to double-click with the mouse on the line of the grid to select the single data item and confirm automatically.

The videos are always acquired in size 640 x 480, even if they are displayed small.

The test acquisition can be simulated even if the OptoJump Next hardware device is not connected. The keys that simulate the device are:

- **F8** – when pressed simulates the status *“inside the measurement area”*, when released simulates the status *“out of the measurement area”*
- **F4** – every time it is pressed, it simulates an external impulse (e.g. photocell, etc.)

**Note:** the only function that cannot be simulated is the acquisition of a Sprint/Gait test: in fact, it is not possible to know the length of steps. However, this type of test is allowed, but obviously the test will finish without the acquisition of steps.

### 5.2.1.1 EXECUTE CONFIGURATION

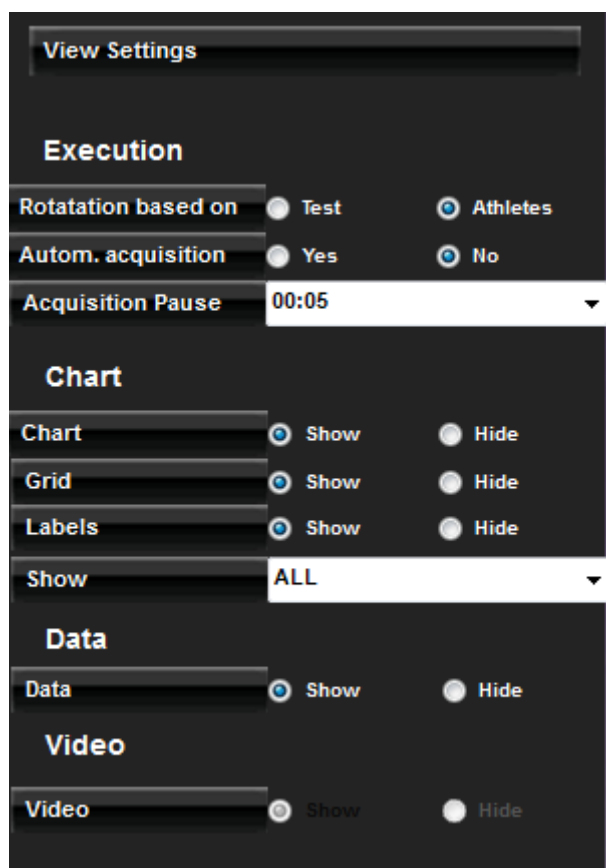


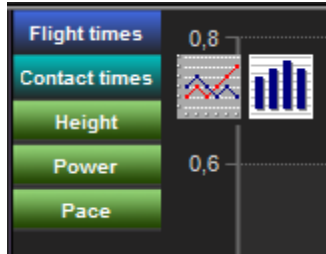
Figure 31 – Execute Configuration

Test data viewing can be configured by the user. The parameters are:

- Execution
  - **Rotation based on:** if more than one test or athlete is selected, this indicates the chosen mode
    - **Test:** after each performance, the next test begins for the same athlete
    - **Athlete:** after each test performance this goes on to the next athlete doing the same test
  - **Automatic acquisition:** if this parameter is set to Yes, it is possible to skip the manual saving phase at the end of each test; when the athlete finishes a test, it is saved, then, after a few seconds (as configured in the parameter 'Acquisition Pause') the next test begins automatically (performed by the same athlete or by another, depending on the settings).
  - **Acquisition Pause:** indicates the pause time between one test and another, which are acquired automatically. Used only if Automatic Acquisition = YES

- **Chart**

- **Chart:** shows/hides the chart during the execution; if 'show' is chosen, it is possible to choose which values to display (Flight times, Contact times, Height, Power, Pace, etc.) and how (bars or lines)



- **Grid:** shows/hides the white-dotted lines forming a grid on the chart
- **Labels:** displays/hides the labels for the numerical values on each spot of the chart



- **View:** displays the last n-number of acquired data items.

- **Data**

- **Data:** shows/hides the numerical data table with its lines and columns

- **Video**

- **Video:** shows/hides the videos acquired by the webcam

## 5.2.2 DEFINE / EDIT TESTS

In this section the definitions of the tests to be performed can be defined or edited.

As described in the section above, in the OptoJump Next software the definition, execution and viewing of tests are often characterized by three categories: Performance (athletic performance), Gait Analysis and Rehab (rehabilitation).

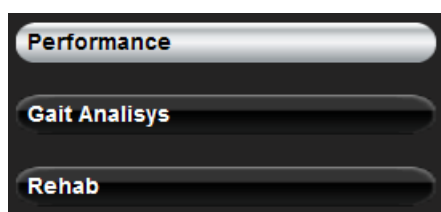


Figure 32 – Test Macrotypology

These categories are used to filter data in order to prevent, for example, viewing the results for athletic performance together with those for rehabilitation. Click on one of the three categories to view the list of tests pre-defined by Microgate or those you have added yourself in the grid (in the example below 'Three Jumps' is a test added by the user).

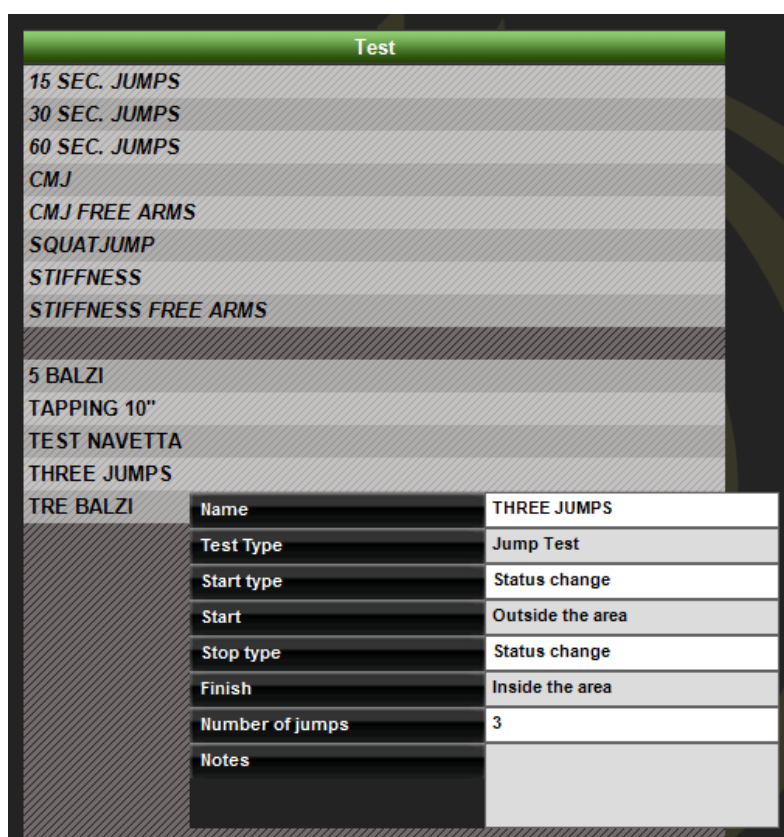


Figure 33 - Define / Edit Tests

If the mouse is pointed on a test, its characteristics (which are those that will be used to define a new one) will be displayed.

By pressing <New Test> the section for defining a test is opened.

The fields necessary for defining a test are the following:

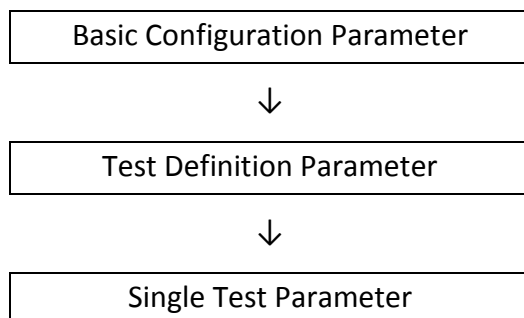
- **Name:** name identifying the test type (e.g. 'left foot monopodalic' or 'continuous jumps 30 seconds', etc.)
- **Test Type:** this type indication is very important and conditions the fields below, which appear dynamically only after the type has been chosen from this drop-down menu:
  - **Jump Test:** type of test that measures flight time (and consequently height), as well as contact time during a series of jumps (in the former version this was called *Contact/Flight time*)
  - **Reaction Times:** measures the reaction time to a visual or sound stimulus
  - **Sprint and Gait Test:** test for the analysis of a run or walk; in addition to flight and contact times, step or stride length, and consequently other indicative parameters are also registered (in the former version this was called *Walkjump*)
  - **Treadmill Running Test:** test analyzing running to be used on a treadmill (in the former version this was called *Rolljump*).
  - **Treadmill Gait Test:** test analyzing gait to be used on a treadmill
  - **Tapping Test:** frequency test registering separate data for each foot
- **Notes:** Mnemonic general notes on the test definition.
- **Example movie:** with the webcam connected it is possible to acquire a movie clip that can be viewed in the future as a reminder. Press <Acquire> to acquire the movie and <Play> to view it

#### 5.2.2.1 MAIN AND SECONDARY PARAMETERS

The parameters of a given test type are divided into Main Parameters and Secondary Parameters. To switch from one mask to another, press the corresponding button on the right.

Secondary parameters are the same in the Utility menu under Basic Settings (chap. 5.4.1.2, 5.4.1.3 and 5.4.1.5). When creating a new test definition, the values of these parameters are retrieved from the general data. It is possible to edit them for a specific test for particular needs. All tests of that type will then have the modified parameter. It is also possible to change one of these parameters in a SINGLE test (the test of Mario Rossi on April 12th), without influencing the test definition itself.

Therefore it is important to understand how the secondary parameters have a hierarchical structure and a sort of parent/child relation.



For example:

Under Utility/Basic Configuration set the 'Minimum contact time' to 60 ms. From this moment every time new types of 'Jump Test' are created, they will have a default value of 60 ms (and if this value is okay, no further changes have to be performed in 'Secondary Parameters').

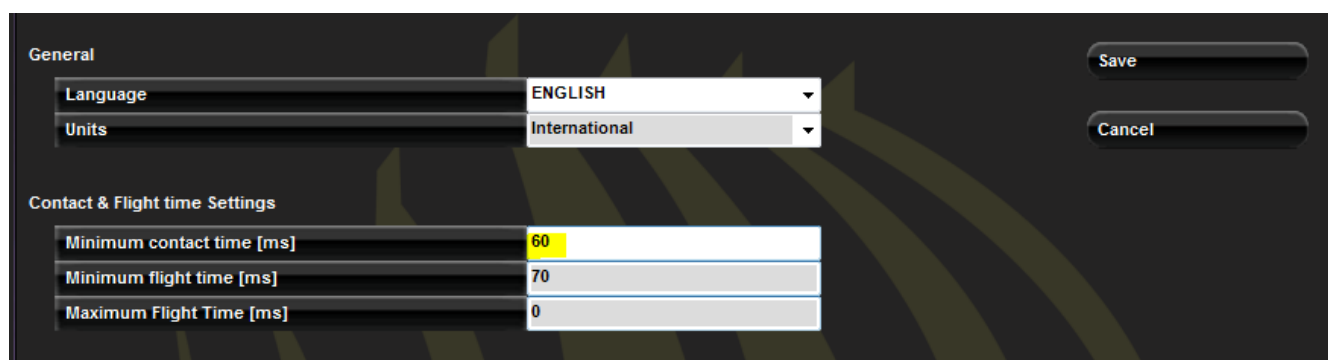


Figure 34 - Basic Configuration Parameters

Let's suppose that for special needs a new test type is needed (e.g. 'Three Jumps') with a different value (e.g. 80 ms). Open <Secondary Parameters>, change the value, and save the test definition.

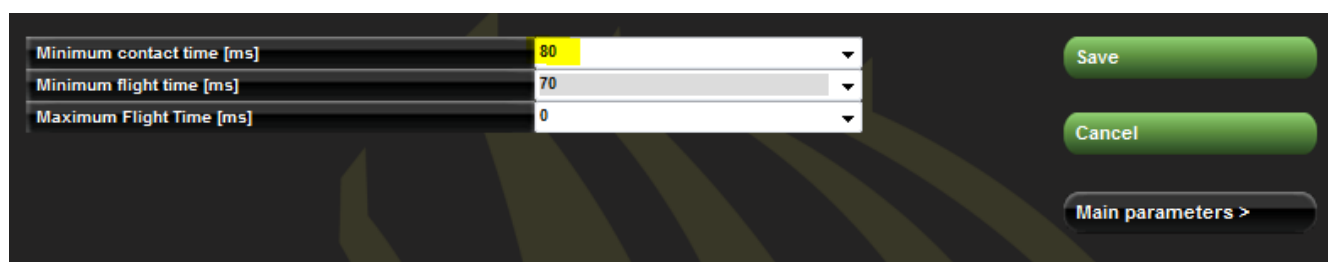


Figure 35 – Test Definition Parameters

Then have the athlete perform the test 'Three Jumps'. The single test, having inherited the values from its type, has of course the parameter 80 ms. Opening View Test (chap. 5.3.1) and pressing <Settings>, the following window is displayed:

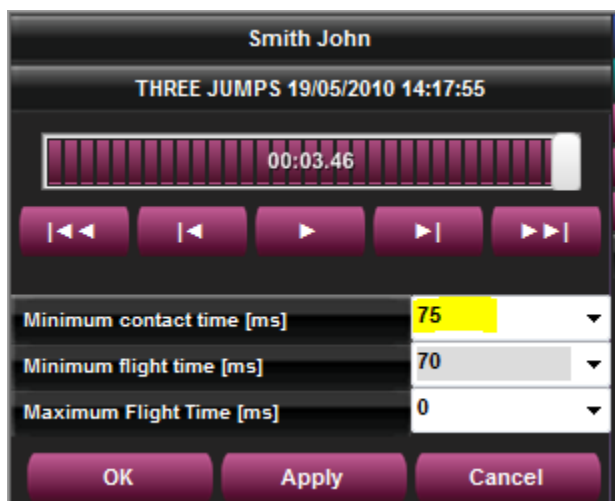


Figure 36 – Single Test Definition Settings

However it might be necessary to change the parameter ONLY for this single test. Insert for example 75 ms and press <OK> or <Apply>. Now (after all values have been recalculated) the data in the table with the numeric results and the charts change. If the results are okay, confirm by pressing <OK> and answer <YES> when asked to save the data (the difference between OK and Apply is that <OK> asks to confirm saving the new parameters and closes the function, whereas <Apply> does not close and allows to further adjust the parameters).

If now the correct value proves to be 75 ms and all future tests should have this value, the parameter has to be changed in the test definition.

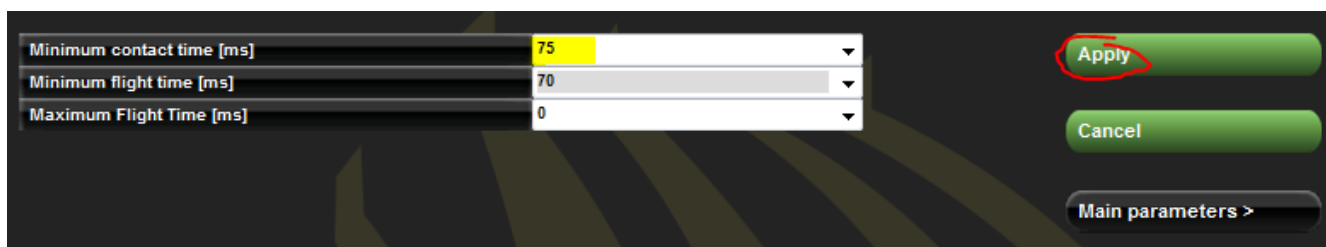


Figure 37 – Parameter editing in a Test Definition, when tests have already been performed with this definition.

TIP: With respect to Fig. 37 the button is called <Apply> and not <Save>.

Now it is possible to decide whether this change should be applied to future tests (press <NO>) or if the change should be applied also to all tests performed with this type (overwriting possible custom values set in the single tests); in the latter case, press <YES>.

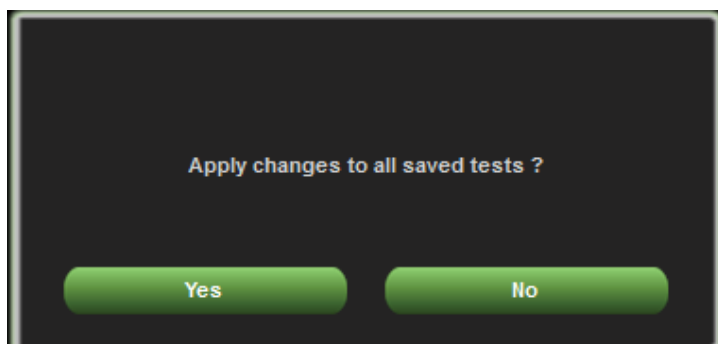


Figure 38 – Confirming the parameter application to tests that have already been performed

The available fields for the different test types are the following:

## ***Jump Test***

### **Main Parameters**

- **Start type:** Indicates if the start of the test must take place with a 'status change' (i.e. entering or exiting the bars) or with an 'external impulse' coming from the jack sockets (start button, signal light, etc.)
- **Start:** indicates if at the beginning of the test the athlete must be '*inside the area*' of the bars or '*outside the area*'
- **Stop type:** As for the start, the end of the test can take place because of a '*status change*' or an '*external impulse*', or (in the case of time tests) the end of the test time (e.g. a test "Jumps 15 seconds" will have the Stop type = '*End of Time*').
- **Finish:** for the Stop type = '*Status change*' it is necessary to specify if, at the end of the test, the athlete must be '*inside the area*' of the bars or '*outside the area*'; in the other two Stop type cases this field does not appear
- **Number of Jumps:** appears only if the Stop type = '*Status change*' and specifies how many times the athlete must jump (from 1 to 99)
- **Test length:** appears only if Stop type = '*End of Time*' and specifies how many minutes:seconds the test must last (from 00:01 to 09:59)
- 

### **Secondary Parameters**

- **Minimum contact time [ms]:** allows to set a minimum contact time in milliseconds; if the contact time is shorter, it is considered incorrect; so if the system registers a contact time shorter than this value, the time is added to the associated flight time (usually the previous one). This control can be enabled/disabled by inserting the value 0.
- **Minimum flight time [ms]:** allows to set a minimum flight time in milliseconds; if the flight time is lower, it is considered incorrect; if the system registers a flight time shorter than this value, the time is added to the associated contact time. This control can be enabled/disabled by inserting the value 0.
- **Maximum flight time [ms]:** allows to set a maximum flight time in milliseconds; if the flight time is higher, it is considered incorrect; if the system registers a flight time longer than this value, the time is not considered.



## Reaction times

### Main Parameters

- **Start type:** Indicates what type of reaction the test must assess, that is:
  - “*Visual stimulus*”: on the PC screen a red circle becomes green after a random period of time; the athlete must ‘react’ to this stimulus (for example, by jumping)
  - “*Acoustic stimulus*”: the reaction stimulus is a sound emitted by the PC (using either an internal loudspeaker or a sound board) after a random period of time.
  - “*Visual/Acoustic stimulus*”: the visual (red/green circle) and the acoustic stimuli (beep from the PC) alternate randomly
  - “*External impulse*”: the start to calculate the reaction time is given by a device (e.g. a start horn or a start button) connected to the jack sockets
- **Start:** indicates if at the beginning of the test the athlete must be ‘*inside the area*’ of the bars or ‘*outside the area*’
- **Minimum pause:** minimum pause time in minutes:seconds between one test and another (the pause will have this minimum value, but being random it will almost always be longer)
- **Number of repetitions:** indicates how many repetitions (from 1 to 99) the test must consist of
- **Sequence type:** the sequence can be ‘*Automatic*’ (the test repetitions follow each other automatically) or ‘*Manual*’ (at the end of each repetition the start of the next test must be confirmed)
- **Stop type:** this can only happen by ‘Status change’

### Secondary Parameters

- Minimum contact time [ms]: see above
- Minimum flight time [ms]: see above
- Maximum flight time [ms]: see above
- **Reaction time range [ms]:** indicates the time frame in milliseconds within which the reaction signal must be given randomly.

## ***Sprint and Gait Test***

### **Main Parameters**

- **Start type:** Indicates if the start of the test must take place with a '*status change*' (i.e. entering or exiting the bars) or with an '*external impulse*' coming from the jack sockets
- **Start:** indicates if at the beginning of the test the athlete must be '*inside the area*' of the bars or '*outside the area*'
- **Starting foot:** if known, the foot with which the test starts ("*right*" or "*left*") can be indicated, otherwise leave as "*not defined*"
- **Stop type:** Indicates how the end of the test must be interpreted, i.e. as '*external impulse*' (e.g. a photocell at the end of the lane) or as '*timeout*' (the number of milliseconds of Test timeout can be customized in Utility – Basic Configuration)
- **Finish:** for the Stop type = '*Timeout*' it is necessary to specify if, at the end of the test, the athlete must be '*inside the area*' of the bars or '*outside the area*'
- **Test length:** appears only if Stop type = '*End of Time*' and specifies how many minutes:seconds the test must last (from 00:01 to 09:59)
- **Number of intermediate times:** Indicates how many intermediate times are inserted between the start and the stop (from 0 to 99)

### **Secondary Parameters**

- Minimum contact time [ms]: see above
- Minimum flight time [ms]: see above
- Maximum flight time [ms]: see above
- **External signal holdoff [ms]:** is the holdoff time between two consecutive external signals. Caution has to be applied for this value, because it may depend on the type of test being carried out
- **Entry point:** allows to indicate if the entry point of the Sprint/Gait test is entering from the '*interface side*' (drum) or from the '*opposite side*'. If '*automatic*' is chosen, OptoJump Next automatically calculates the direction, considering the LED nearest the center of the foot as the beginning of the LEDs.
- **Step length calculation:** allows to choose whether to calculate step length as the distance between the tips of two following feet or as the distance between the heels of two following feet (see also Figure 75 - Tip to Tip or Heel to Heel Step Length
- )
- **Minimum step length [cm or ft]:** is the minimum step length in centimeters (or inches), used as a basis to calculate the step length for a Run/Gait test.
- **Minimum foot length [cm]:** is the minimum foot length in centimeters (or inches), used to filter possible incorrect acquisitions.
- **Split 1 or 2 at distance [cm]:** insert at how many cm from the start the first or second split time will be taken; leave 0 to disable split times
- **Test timeout [ms]:** this is the end of test timeout in milliseconds; if during a Sprint/Gait test with '*Timeout*' stop type no input or output signal is received from the

measurement area by the OptoJump device for a period longer than or equal to the time set here, the test is considered completed.



- **3rd/6th/9th step speed reference:** insert the reference speed for the 3<sup>rd</sup> / 6<sup>th</sup> / 9<sup>th</sup> step in m/s; inserting the value 0 this option is disabled
- **Consider first step:** if set to No, the length of the first footfall is not taken into consideration.

For this test type the structure of the system has to be defined as well, i.e. how many bars the system is composed of and whether there are gaps between the bars.

In the field 'Number of bars', the number of connected bars must be inserted. This field is necessary for correct test acquisition. If the inserted number of bars differs from the number of bars actually installed, the software will signal this error suspending the test currently in progress.

Example: A system is made of 20 meters of OptoJump bars, all connected together, without gaps. The settings to make are the following:



The  and  buttons are respectively for removing or adding blocks of OptoJump bars. This function can be used, for example, in hurdle jumping, where between one hurdle and the next one interruptions are made connecting bars with a flat cable.

The 'Distance' field is for indicating the distance between the blocks in centimeters. The first 'Distance' ( $D_0$ ) corresponds to the distance between the athlete's initial position and the first block. For example, in athletics, if the start is from the blocks, the distance from the springboard to the first block must be calculated. The other distances ( $D_1$ ,  $D_2$ , etc.) indicate the distance between the last lens of a bar and the first lens of the following bar (end and beginning of the two half moons).

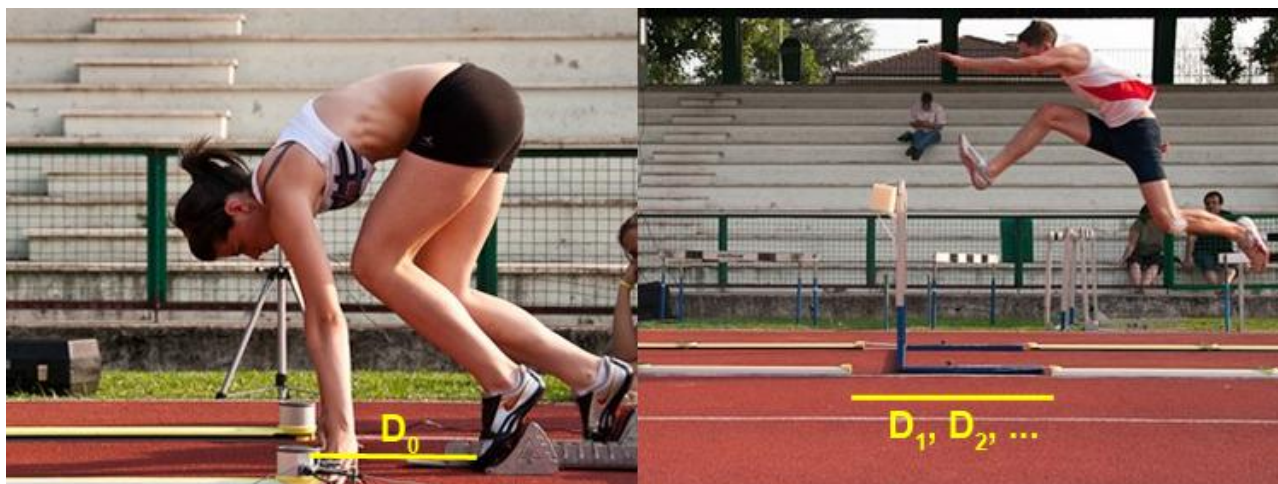


Figure 39– Example: bars with gap

A practical configuration example of a system of 30 m could be the following:

Starting block—50 cm – 13 meters OJ – hurdle – 8 meters – hurdle – 8 meters – hurdle – 1 meter

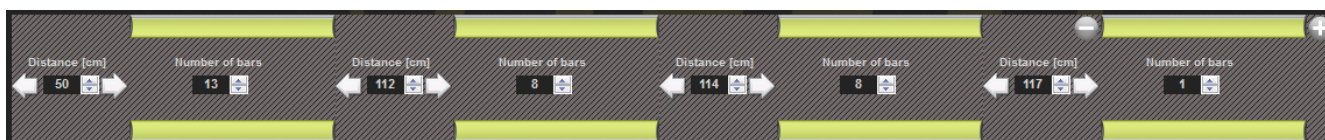


Figure 40 – Configuration of bar blocks

## ***Treadmill Running Test***

### **Main Parameters**

- **Start type:** this can only be '*Software command*'
- **Stop type:** this can only be '*Software command*' or '*End of time*'
- **Test length:** appears only if Stop type = '*End of Time*' and specifies how many minutes:seconds the test must last (from 00:01" to 59':59")
- **Treadmill speed:** indicates the speed in km/h the treadmill is set at; the setting range is 0.1-20.0 km/h with steps of 0.1.

### **Secondary Parameters**

- Minimum contact time [ms]: see above
- Minimum flight time [ms]: see above
- Maximum flight time [ms]: see above

## ***Treadmill Gait Test***

### **Main Parameters**

- **Start type:** this can only be '*Software command*'
- **Stop type:** this can only be '*Software command*' or '*End of time*'
- **Test length:** appears only if Stop type = '*End of Time*' and specifies how many minutes:seconds the test must last (from 00:01" to 59':59")
- **Treadmill speed:** indicates the speed in km/h the treadmill is set at; the setting range is 0.1-20.0 km/h with steps of 0.1.  
**Direction:** Indicates, if the walking direction is 'Interface side' or 'Opposite side'. Therefore, if the interface drums are at the end of the treadmill choose 'Opposite Side', or vice versa.

### **Secondary Parameters**

- Minimum contact time [ms]: see above
- Minimum flight time [ms]: see above
- Maximum flight time [ms]: see above
- Step length calculation: see above
- Minimum step length [cm]: see above
- Minimum foot length [cm]: see above
- **Automatic Data Filter:** from 10% to 90% (default = deactivated); activating this parameter, the user can check if the values for flight time, contact time, gait time, swing time, and step length are within the average value +/- the chosen percentage. If one of these data is out of range, the table line will be deleted from the calculation of average values and the values on the grid will appear in strike-through format (e.g. average = 0.8, filter = 20%, all values above 0.96 and below 0.64 will be deleted).

## Tapping Test

### Main Parameters

- **Start type:** Indicates if the start of the test must take place with a '*status change*' (i.e. entering or exiting the bars) or with an '*external impulse*' coming from the jack sockets
- **Start:** indicates if at the beginning of the test the athlete must be '*inside the area*' of the bars or '*outside the area*'
- **Starting foot:** if known, the foot with which the test starts ("*right*" or "*left*") can be indicated, otherwise leave as "*not defined*"
- **Stop type:** Indicates how the end of the test must be interpreted, i.e. as '*external impulse*' (e.g. a photocell at the end of the lane) or as '*timeout*' (the number of milliseconds of Test timeout can be customized in Utility – Basic Configuration)
- **Finish:** for the Stop type = '*Timeout*' it is necessary to specify if, at the end of the test, the athlete must be '*inside the area*' of the bars or '*outside the area*'
- **Test length:** appears only if Stop type = '*End of Time*' and specifies how many minutes:seconds the test must last (from 00:01 to 09:59)

### Secondary Parameters

- Minimum contact time [ms]: see above
- Minimum flight time [ms]: see above
- Maximum flight time [ms]: see above

In order to perform a Tapping Test it is important that the athlete's feet are vertical to the OptoJump bars



Figure 41 – Correct execution of a Tapping Test

After inserting the data, remember to press <Save> to save and return to the list of defined tests.

To review the parameters of a defined test, pass over them with the mouse, or double-click on them (this is equivalent to pressing <Edit Test>).

Editing a test definition is only possible if no tests using this definition have already been performed.

To delete a test definition, select it from the list and press <Delete Test>; obviously all the tests connected to this definition will be deleted!

To duplicate a test definition (useful for example, if a left-foot test has been defined and the same shall be applied to the right foot, or vice versa), select the test from the list and press <Duplicate Test>. This creates a copy of the test, which can then be renamed and fully edited.

The tests preconfigured by Microgate can be neither edited nor eliminated, but duplicated.



### 5.2.3 DEFINE / EDIT PROTOCOLS

In this section the protocols to be performed can be defined or edited. The protocols can be considered as a pre-defined series of tests to be performed in sequence (e.g. one 'Squat jump' + one 'CMJ' + one 'Jumps 15 sec.').

To create a new protocol, select one of the three test macro-typologies (Performance, Gait Analysis, Rehab) and press <New Protocol>. Insert a mnemonic name and optionally general notes.

Select the tests (in the desired order) that will make up this protocol using the symbol ➡

If a mistake has been made or a test has to be removed from the protocol, use the symbol ⬅

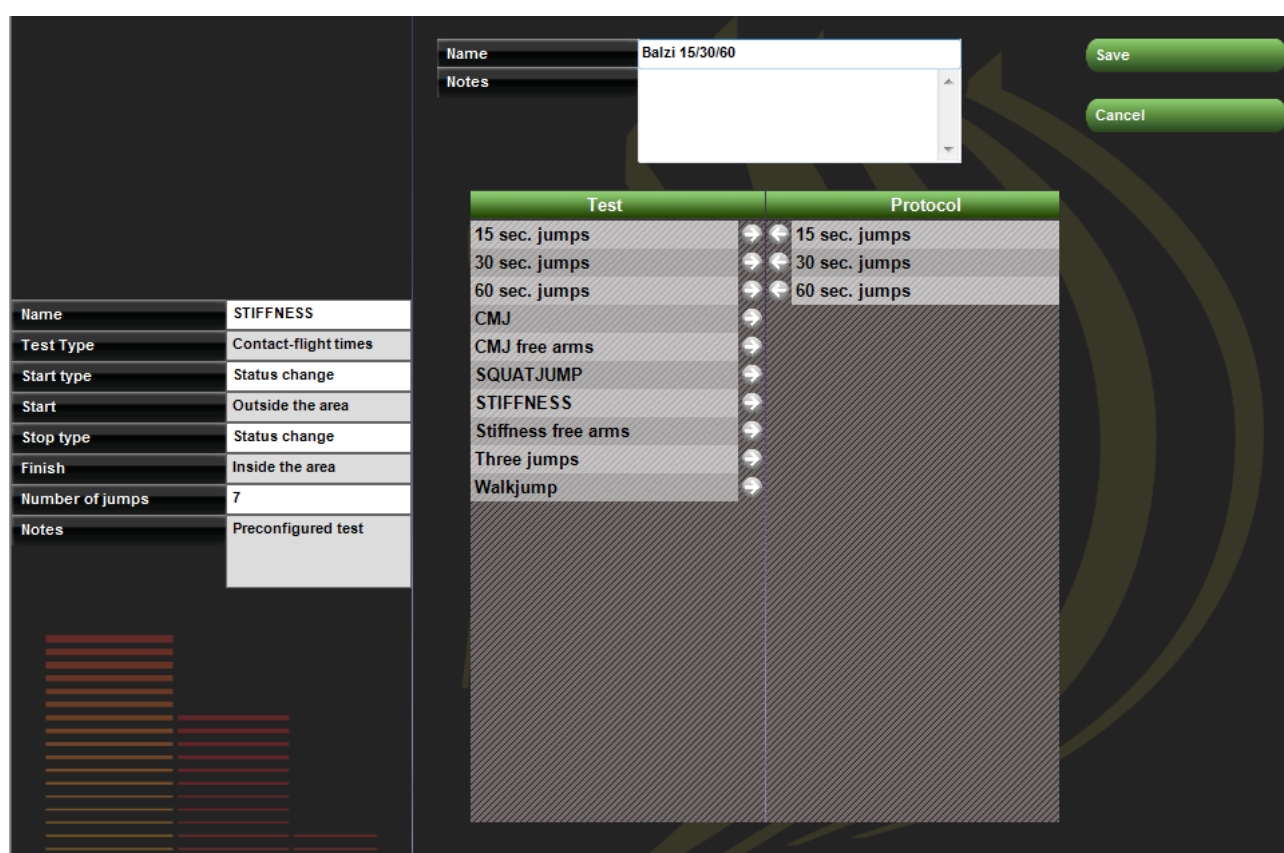


Figure 42 – Creation of a protocol

If you do not remember the parameters of a test definition, place the mouse cursor on it and its characteristics will be displayed.

After inserting the data, press <Save> to save and return to the previous section.

The command <Edit Protocol> allows to edit its name and notes and to change its composition, while <Delete Protocol> deletes its definition. Unlike the deletion of a test definition, the deletion of a protocol does not cause the chain-effect deletion of all correlated tests but only the connection they had with the protocol. After its deletion, the tests performed by the athletes will be found again as 'single tests' no longer related to the protocol.



## 5.3 RESULTS

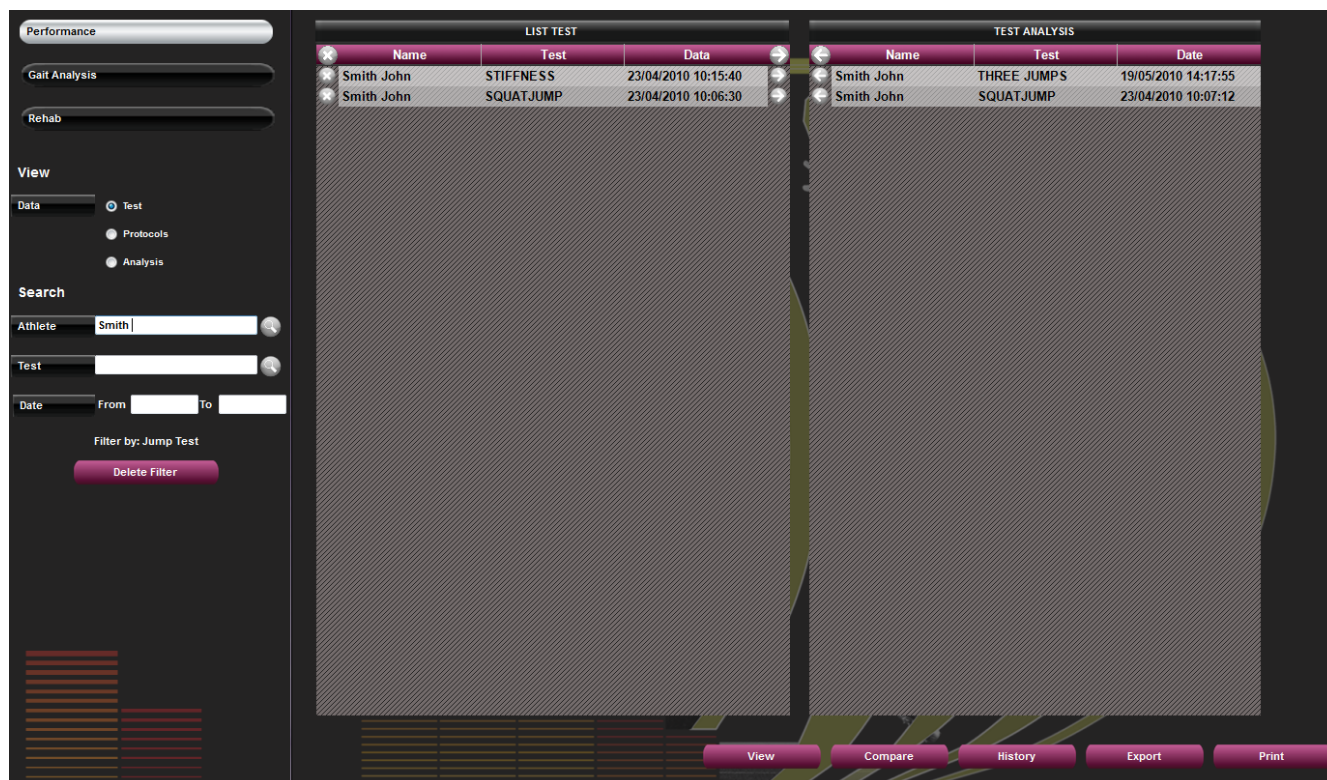


Figure 43 – Results

In the Results section, the performed tests or protocols are displayed. For better understanding these three terms are defined as follows:

**Test:** is a single test (e.g. 15" jumps) performed on a certain date by a single athlete.

**Protocol:** is a pre-defined list of tests to perform in sequence

**Analysis:** when a single test is displayed or when two tests are compared, certain configuration parameters may be set for the video, the table with numerical data, charts, reports, printouts, etc. It is furthermore possible to draw on still pictures, insert notes, 'sign', delete incorrect data, etc. All these operations can be saved in an *Analysis* (using a mnemonic name), which can then be recalled without having to reset all parameters.

The RESULTS window is divided into 3 parts (from left to right):

- **FILTERS:** panel for looking for a single test or for filtering according to various parameters
- **TEST LIST:** contains all the tests made, possibly filtered by your parameters; the same window also displays the list of saved analyses
- **TEST ANALYSIS:** contains the tests/analyses manually selected for viewing, comparing, printing, or exporting.

## Filters Panel

Select one of the three macro-categories (Performance, Gait Analysis, Rehab) using the corresponding buttons and with the 'Data' radio button select whether single tests, protocols or analyses should be viewed.

In the latter case, with the  and  icons expand or collapse the tests contained in the protocols.






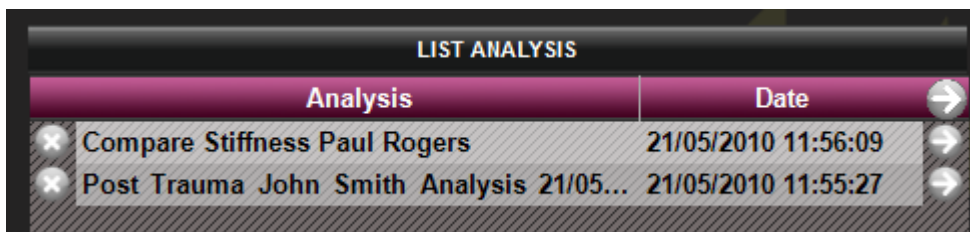
LIST TEST				
	Athlete	Test	Date	
	Rossi Pierluigi	CMJ+Balzi	29/06/2009 12.1...	
		15 sec. jumps	29/06/2009 12.1...	
		CMJ	29/06/2009 12.1...	
	Rossi Pierluigi	Valutazione gin...	05/05/2009 10.4...	
		STIFFNESS	05/05/2009 10.4...	
		CMJ	05/05/2009 10.4...	
		SQUATJUMP	05/05/2009 10.4...	

Figure 44 – Expanded Protocols List

Choosing 'Analyses' all saved analyses will be viewed with the saving date (which can be much later than the execution of the analyzed tests)






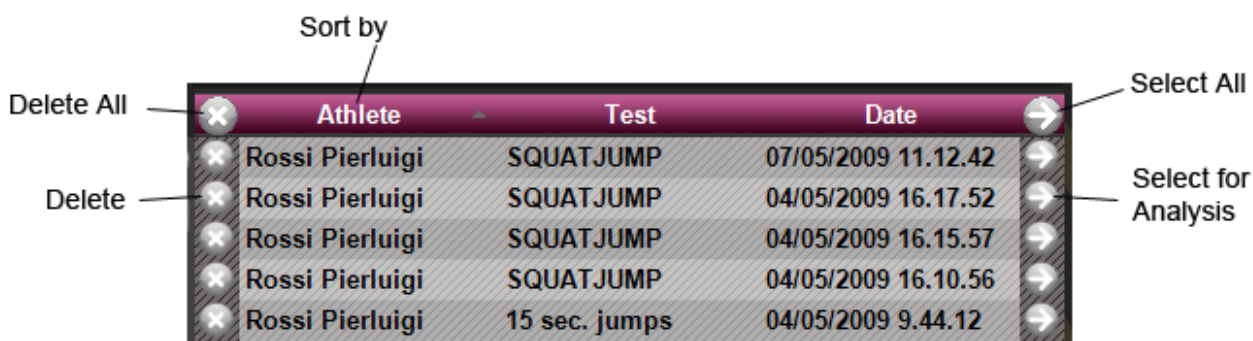
LIST ANALYSIS	
Analysis	Date
 Compare Stiffness Paul Rogers	21/05/2010 11:56:09
 Post Trauma John Smith Analysis 21/05...	21/05/2010 11:55:27

Figure 45 – Saved Analyses

To look for an athlete or a test/protocol, the data can be inserted manually into the search boxes (e.g. key in 'Rossi' in the Athlete field or 'CMJ' in the Test field) or press  to display a list of athletes or tests to choose from. Similarly it is possible to filter by data by inserting a range of data with the calendar control.

To view all the tests and reset the various filters, press <Delete filter>.



## Test List




Athlete	Test	Date
Rossi Pierluigi	SQUATJUMP	07/05/2009 11.12.42
Rossi Pierluigi	SQUATJUMP	04/05/2009 16.17.52
Rossi Pierluigi	SQUATJUMP	04/05/2009 16.15.57
Rossi Pierluigi	SQUATJUMP	04/05/2009 16.10.56
Rossi Pierluigi	15 sec. jumps	04/05/2009 9.44.12



Figure 46 – Test List Components

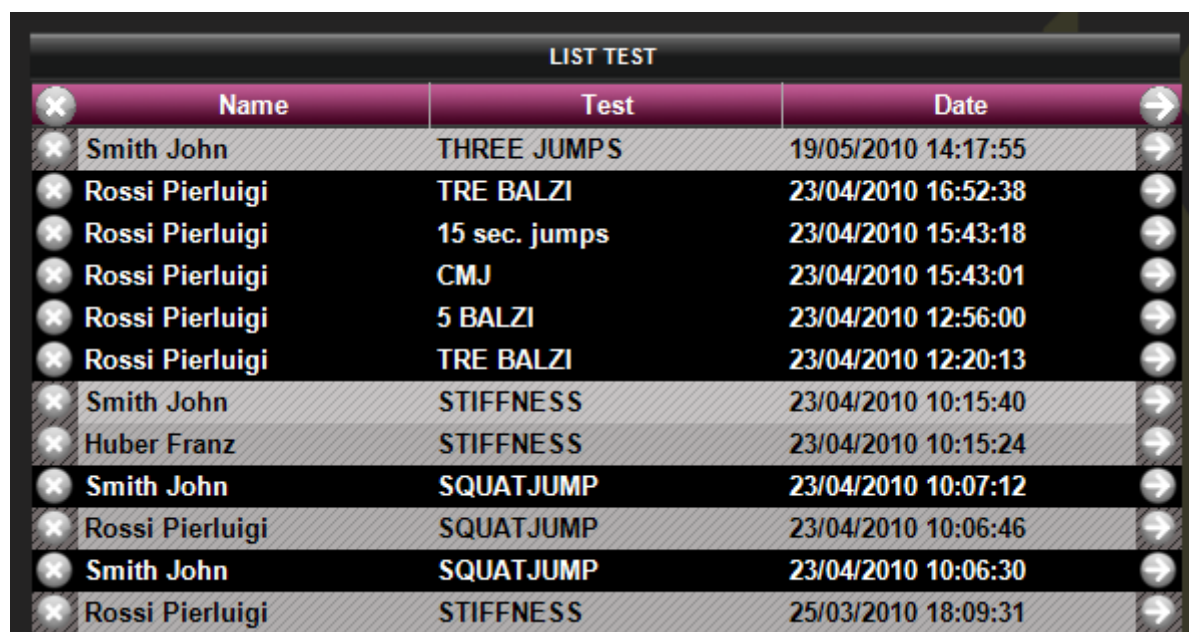
Click on the column names (Athlete, Test, Data) to display the list in order according to that field. Press again to reverse the order (A...Z, Z...A).

To delete a test, press the  symbol on the corresponding line of the chosen test; to delete all displayed tests press  on the table heading (at the top).

To select a test to analyze press the symbol  on the corresponding line (or double-click with the mouse): the test will be moved from the LIST table to the ANALYSIS table and a filter will automatically be set on the type of test (e.g. if a 'Squatjump' test is chosen, the Test List is filtered in order to contain only 'Jump tests'; this allows to choose only tests of the same type to be submitted to 'Comparison').

To add all displayed tests press  on the table heading.

To make multiple selections, use the **SHIFT** key to select a range of athletes (from... to...) or the **CTRL** key for selections that are not adjacent, as explained in section 5.1.2. Pressing  only the selected tests will be moved, whereas pressing  those lines will be deleted.

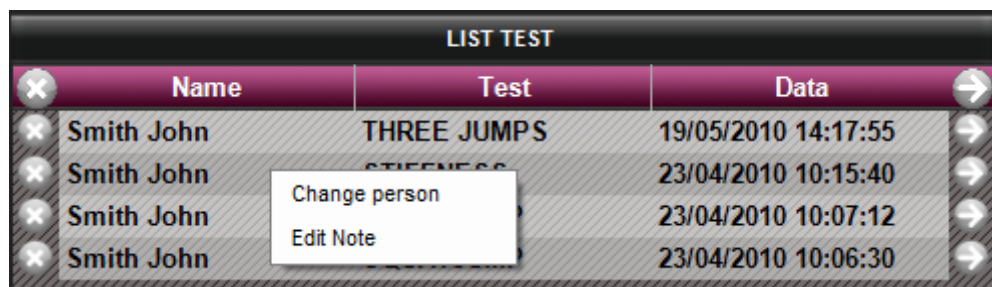


Name	Test	Date
Smith John	THREE JUMPS	19/05/2010 14:17:55
Rossi Pierluigi	TRE BALZI	23/04/2010 16:52:38
Rossi Pierluigi	15 sec. jumps	23/04/2010 15:43:18
Rossi Pierluigi	CMJ	23/04/2010 15:43:01
Rossi Pierluigi	5 BALZI	23/04/2010 12:56:00
Rossi Pierluigi	TRE BALZI	23/04/2010 12:20:13
Smith John	STIFFNESS	23/04/2010 10:15:40
Huber Franz	STIFFNESS	23/04/2010 10:15:24
Smith John	SQUATJUMP	23/04/2010 10:07:12
Rossi Pierluigi	SQUATJUMP	23/04/2010 10:06:46
Smith John	SQUATJUMP	23/04/2010 10:06:30
Rossi Pierluigi	STIFFNESS	25/03/2010 18:09:31

Figure 47 – Multiple selection

From the test list it is possible to perform two operations by **RIGHT CLICKING** on one test line, more precisely:

- **Change person:** allows to associate a test with another person, if the wrong association was made during execution; select the command and choose an athlete from the displayed mask; press <Confirm> to choose the new person
- **Edit note:** allows to view/edit the note inserted immediately after test completion; the note will be printed on the report in the General Data section on the first page of the test





LIST TEST		
Name	Test	Data
Smith John	THREE JUMPS	19/05/2010 14:17:55
Smith John	STIFFNESS	23/04/2010 10:15:40
Smith John		23/04/2010 10:07:12
Smith John		23/04/2010 10:06:30

Figure 48 – Context menu under a single test

## Test Analysis







To view a single test, select the corresponding line in the 'TEST ANALYSIS' table and press the button <View> (or double-click with the mouse). See chap. 5.3.1 View  
To compare two tests, insert the relevant tests in the 'TEST ANALYSIS' table and press the button <Compare>. See chap.5.3.2  
The button is disabled if the number of tests in the window is less than two.

To remove a test from the analysis, press  on the corresponding line in the 'TEST ANALYSIS' table, whereas to delete all the tests displayed press  on the table heading.

To analyze the history insert two or more tests in the 'TEST ANALYSIS' table and press the button <History>. See chap.5.3.3.

To export the data to Excel, add at least one test to the 'TEST ANALYSIS' table and press <Export>. A dialog box asks if the extended version (for each data line the test heading and athlete's data are repeated) or the simple version (only numerical test data) should be displayed.

Pressing <Print> n-number of reports in PDF format are generated, the number corresponding to the number of tests shown in the 'Test analysis' window. Before generating the output, the output directory for the above files must be selected.

TEST ANALYSIS		
	Name	Test
	Rossi Pierluigi	STIFFNESS
	Rossi Pierluigi	STIFFNESS
	Rossi Pierluigi	STIFFNESS
	Rossi Pierluigi	STIFFNESS
	Rossi Pierluigi	SQUATJUMP
	Huber Franz	SQUATJUMP
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		
		

View

Compare

History

Export

Print

Figure 49 – Test list to analyze



### 5.3.1 VIEW

In this section the test selected is displayed.

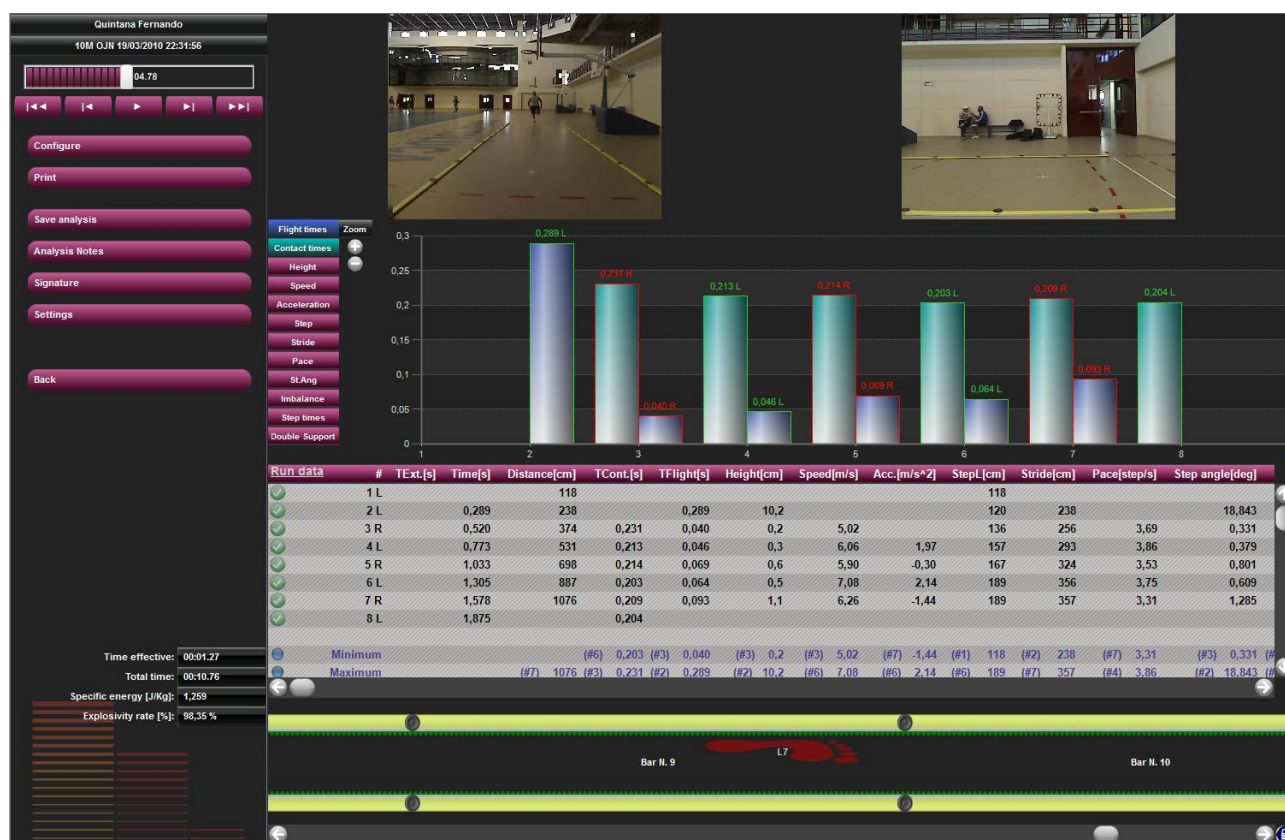


Figure 50 – View

The items on the left from top to bottom are the following:

- name of the athlete
- test type and execution date
- VCR player with slider and commands for managing the acquired video/s
- command buttons for activating various functions
- <Back> button to close the mask View and go back to the Test list.
- total test data

On the right there are 4 types of information regarding the current test; each set of information can be shown/hidden using the configuration commands.

The items from top to bottom are the following:

- **Videos** acquired by (one or two) webcam/s; if the webcams are not connected when the test is performed, a fixed image with the Microgate logo will appear
- **Charts** displaying the results: it is possible to choose the chart type (lines or bars) and the measurement to be displayed (times, heights, powers, etc.)

- **Table with numerical data:** a grid with various lines and columns displays actually acquired data and calculated data; at the bottom of the table statistical and aggregated data are displayed (average, minimum, maximum, etc.)
- **OptoJump bars:** displays the n-number of bars connected at the time the test is carried out and which LEDs turn on during the test

The table shows the list of all the external, flight and contact times acquired during the test. The data has been processed to obtain further information such as jump heights, energy, developed power, etc. See chap.6.1.

In the case of Sprint/Gait test, step length, speed, and acceleration are also displayed.

By checking the various rows, invalid flight and/or contact times can be deleted, see chap. 6.2

In the bottom left area total test data is displayed, such as:

- **Effective time [mm:ss.dd]:** actual time of the test in the format minutes, seconds and milliseconds; this is the difference between the actual start of the test, calculated from the first event (eg. the first take-off from the ground), and the end of the test.
- **Total time [mm:ss.dd]:** total time of the test in the format minutes, seconds and hundredths of a second; this is the difference between the start of the test, signaled by the acoustic signal, and the end of the test. If, for example, 10 seconds pass between the two start beeps and the end of the test and the athlete begins to jump 3 seconds after the first beep, the two values will be Total time = 10, Effective time = 7
- **Specific energy [J/kg]:** specific energy produced during the test calculated with the following formula:

$$\sum h_{jumps} \cdot g$$

- **Specific power [W/kg]:** specific power expressed during the test calculated with the following formula:

$$\frac{g^2 \cdot \sum T_f \cdot (\sum T_f + \sum T_c)}{4 \cdot n^{\circ} jumps \cdot \sum T_c}$$

Where  $T_f$  = Flight Time,  $T_c$  = Contact Time

- **Athlete's weight [kg or lb]:** athlete's weight in kg or pounds
- **Total energy [J]:** if the athlete's weight is available, this field contains the total energy expressed by the athlete during the test (SpecificEnergy \* AthleteWeight)
- **Total power [W]:** if the athlete's weight is available, this field contains the total power expressed by the athlete during the test (SpecificPower \* AthleteWeight)

At the top left (see figure below) is the command panel for checking test progress.



Figure 51 – Command panel

From left to right the commands available are:

- Back to the start of the test
- Back one frame
- Play/Stop
- Forward one frame
- Forward to the end of the test

Move the progress bar (slider) by moving the cursor with the mouse.

Instead of the buttons Back/Next the right and left arrow keys on the keyboard can be used to move forward/backward by single frames, whereas CTRL+Right Arrow and CTRL+Left Arrow allow to move by a thousandth of a second.

### 5.3.1.1 CONFIGURATION PANEL

Pressing <Configure> displays the choices available

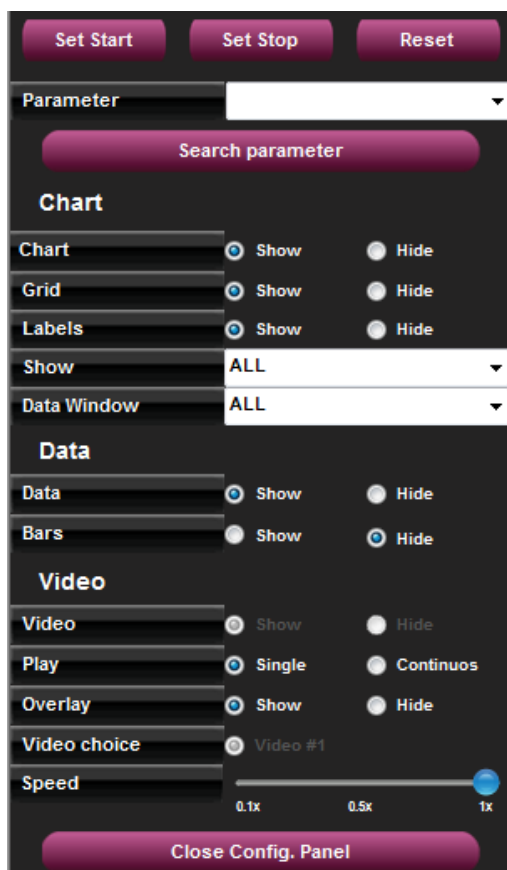


Figure 52 – Configuration Panel for the View test function



The <Set Start>, <Set Stop> buttons are for defining the start and end respectively of the part of interest. Place the cursor at the start and finish points of the desired movie clip and press <Set Start> and then <Set Stop>. Thus a part of the movie clip is isolated, deleting the uninteresting 'dead' periods.



Press <Reset> to cancel the 'Start' and 'Stop' references and restore them to their initial values.

With <Search Parameters> it is possible to look for a parameter selected from the 'Parameter' drop-down menu; e.g. select 'first flight time' and press Parameter Search: you will see the film clip and the slider go forward to the frame corresponding to the athlete's first take-off from the ground. By using 'Next T.Flight', you will go forward to the next corresponding event. This function is very useful when comparing two tests.

The display of test data can be configured by the user:

- Chart
  - **Chart:** shows/hides the chart
  - **Grid:** shows/hides the dotted lines forming a grid on the chart
  - **Labels:** shows/hides the labels for the numerical values of the times on the chart
  - **View:** shows all the data acquired or only certain data; in this case a scrollbar allows to move to the right and left inside the chart
  - **Data Window:** in the table of numerical data displays only the n-number of data based on the window in blue shown in the chart. To move the window, right-click it with the mouse and drag it onto the chart.

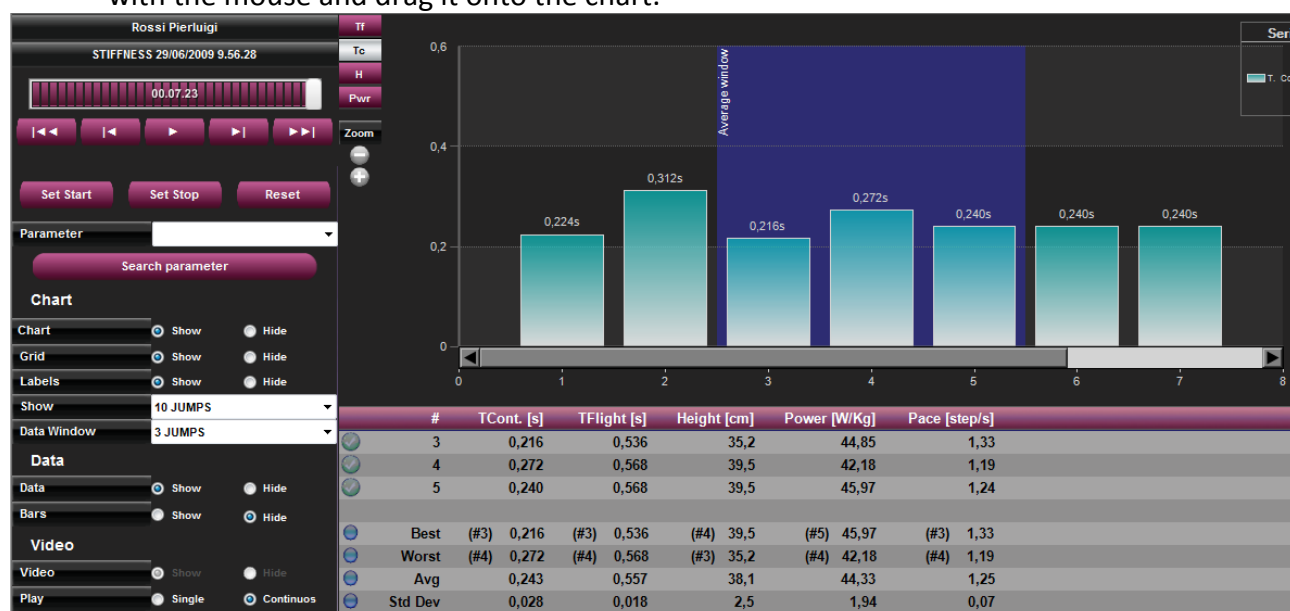



Figure 53 – Display 10 events at a time and take 3 of them into consideration (blue window)

- Data
  - **Data:** shows/hides the grid with numerical data

- **Bars:** shows/hides the OptoJump Next bars
- **Video**
  - **Video:** shows/hides the acquired video
  - **Play:** you can play 'Single' (only once) or 'Continuous' (looping the test)
  - **Overlay:** using graphical tools draw on a still picture and save this image as an overlay (  ); use this flag to show or hide it
  - **Video choice:** Allows to choose whether to show or hide one of the two videos
  - **Speed:** sets the playing speed: normal (1x) or slowed down by a factor from 0.1x to 0.9x

The Configuration panel can be closed (i.e. minimized) using the button << in the upper left corner. Only the video commands (play, stop, ff-fw, rew, etc.) are available, allowing to view the test. Use >> to open again the panel.

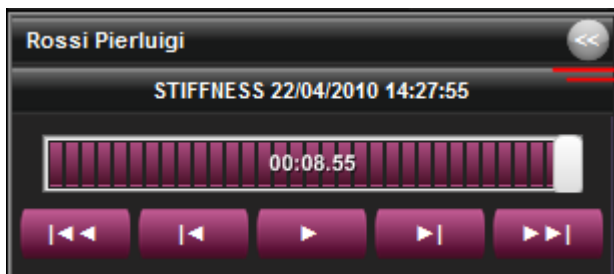


Figure 54 – Open Configuration panel

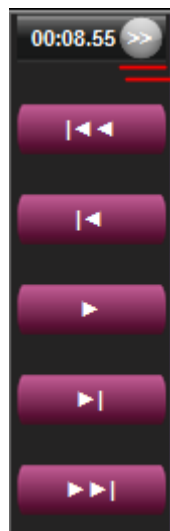






Figure 55 – Closed Configuration panel

### 5.3.1.2 CHARTS

In OptoJump Next charts there are usually some possible viewing possibilities. e.g. in Figure 10 'Flight times' and 'Contact times' are displayed. To change view type just left-click with the mouse on another option (such as 'Power' or 'Height'). The buttons have the same colors as the chart bars/lines and are therefore used as legend.

In addition, if you place your cursor on one of the buttons, the displayed chart type will appear on the right. It can be lines (  ) or bars (  ). To change the chart type just left-click with the mouse on the corresponding symbol.

By pressing the symbols under 'Zoom' you can increase (  ) or reduce (  ) the chart display.

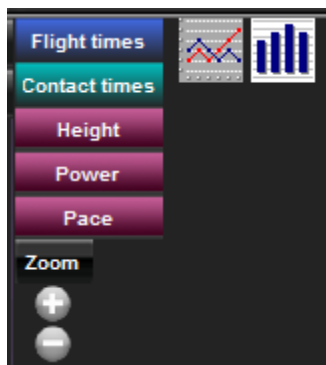


Figure 56 – Chart options

If a setting is not available it is displayed in black, e.g. if no second webcam is connected, the option 'View video#2' is disabled.

The OptoJump Next software has a graphic tool for analyzing images acquired by webcams. To enter this section, just double-click with the mouse on the still picture to process (see chap. 6.3).

Press <Close Config Panel> to close the Configuration panel.

### 5.3.1.3 TABLE WITH NUMERICAL DATA

In 'Jump Tests' or 'Reaction Tests', the numerical data to display are few and therefore almost always fit into one screen.

In Spring/Gait Tests (regular or with treadmill), on the contrary, the numerical data have many columns (a horizontal scrollbar is shown); therefore it has been decided to divide them into two pages: the first with the *Run Data* and the second with the *Gait Data*.

To switch from one screen to another, click on the link on the top left corner of the table.

Run data	#	TExt.[s]	Time[s]	Distance[cm]
✓	1 L			118
✓	2 L		0,289	238
✓	3 R		0,520	374
✓	4 L		0,773	531
✓	5 R		1,033	698
✓	6 L		1,305	887
✓	7 R		1,578	1076

Gait data	#	TExt.[s]	Stance phase[s]	%
✓	1 R			
✓	2 R		0,231	
✓	3 L		0,213	
✓	4 R		0,214	
✓	5 L		0,203	
✓	6 R		0,209	
✓	7 L		0,204	

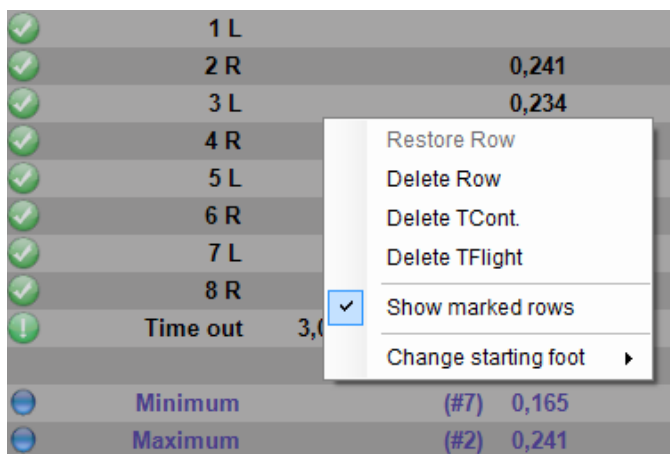
Figure 57 - Run & Gait Data

In Tapping Tests, four pages may be scrolled:

- Left and right foot results
- Left foot results
- Right foot results
- Comparison between right and left foot

#### 5.3.1.3.1 Row Management Menu

When RIGHT-clicking with the mouse on a table row a context menu appears with the following items:



✓	1 L	
✓	2 R	0,241
✓	3 L	0,234
✓	4 R	
✓	5 L	
✓	6 R	
✓	7 L	
✓	8 R	
!	Time out	3,0
⚙	Minimum	(#7) 0,165
⚙	Maximum	(#2) 0,241

Figure 58 – Data row management menu

- **Restore row:** allows to reset a previously deleted row or a row connected to the row above or below as valid
- **Delete row:** deletes the selected row – deleted rows are not considered in the calculation of averages and of total values for the test and are displayed in ~~strikethrough~~ style
- **Delete TCont.** deletes a contact time from the selected row; as a consequence the associated contact and flight times are added to the flight time in the row above
- **Delete TFlight:** deletes the flight time from the line row; as a consequence associated flight and contact times are added to the contact time in the row below
- **Show marked rows:** allows to show/hide deleted rows or rows with deleted flight or contact time
- **Change starting foot:** allows to set the right foot or the left foot as starting foot. It is very useful to use the video to discern with which foot the athlete has started. If you do not have video recordings and you do not remember the foot, specify 'Undefined'.

It should be highlighted that the 'starting foot' is the foot **set as first inside the area** and is the one to be indicated in the pop-up menu. The data of the first row refer to the other foot, though, as this is the THRUSTING foot and not the support foot.

For example in the image below, an athlete enters the OptoJump measurement area with the RIGHT foot (as shown in the video); therefore this is the foot to be indicated in the menu (confirmed by the green footprint shown in the section below).

The data of the first row shows 'L' (left), as it refers to the preceding thrust of that foot. The contact time of the right foot will therefore be printed only on row #2.

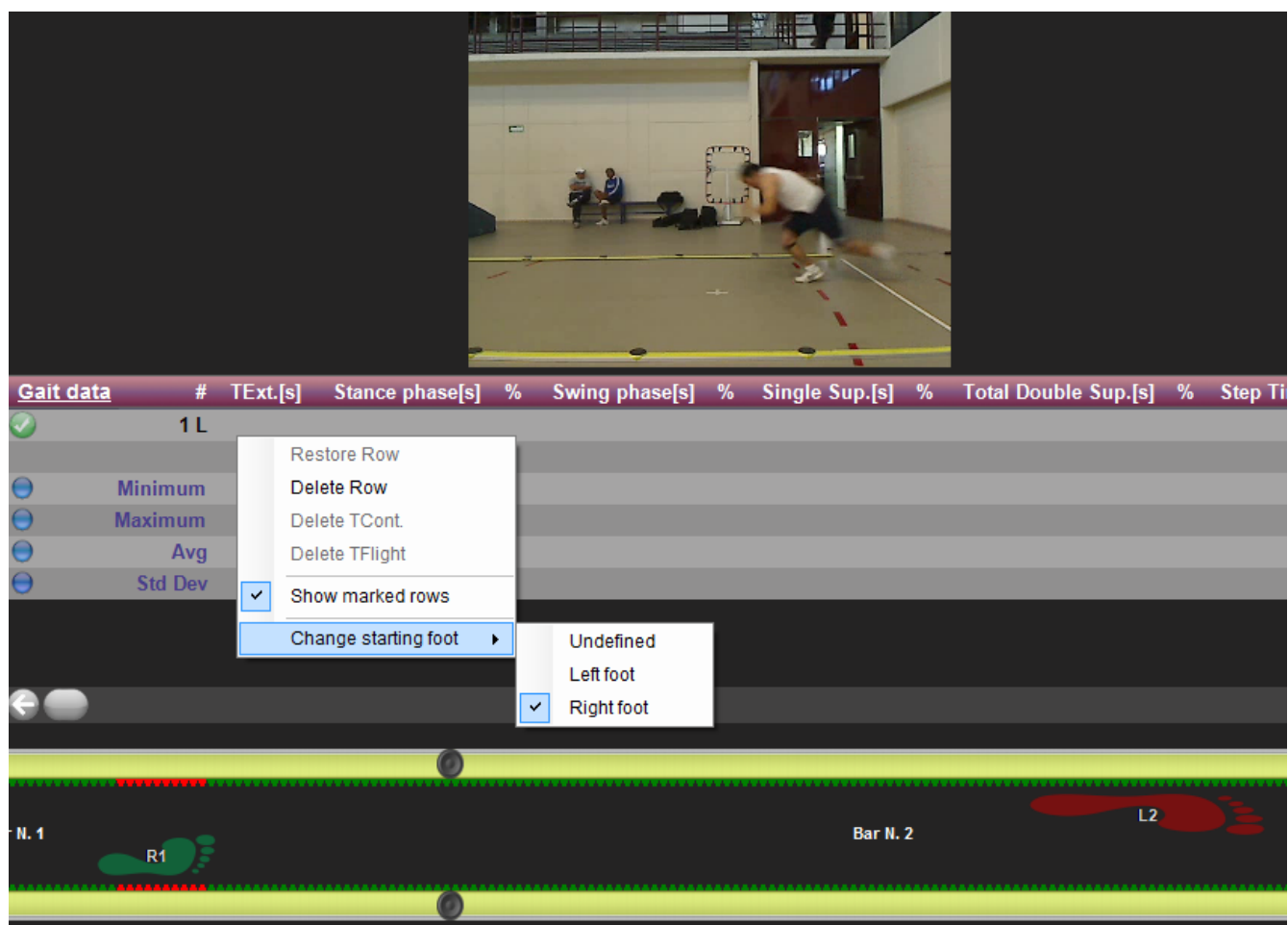


Figure 59 – Choice of starting foot

### 5.3.1.4 VIEWING OF THE OPTOJUMP BARS

The OptoJump bars allow to view afterwards the LEDs that have been interrupted (in red) and, if a starting foot has been set, to view the footfall thanks to the graphical footprints. The footprint length is directly proportional to the number of interrupted LEDs.

Similarly also the labels of the numerical data chart and row values always display which foot they are referring to.



Figure 60 – Indicating the foot on charts, tables and bars

When watching a run/gait video of a modular system composed of many meters, as the time progresses, the bars scroll in synchronization with the video and the charts, allowing to follow the LEDs interrupted during the test.

Bar scrolling can be disabled clicking on the lock icon in the bottom right corner. The button has a toggle function, so when clicked scrolling is enabled again.



From this view a 'Measuring Ruler' can be used to see how many centimeters (or inches) there are between a series of lit LEDs (or anyways between two points). Double-click on the first LED and

then on the second led to view the measure (the markers are green and red for the first and second point). Click anywhere on the bars and ESC to delete the measure.

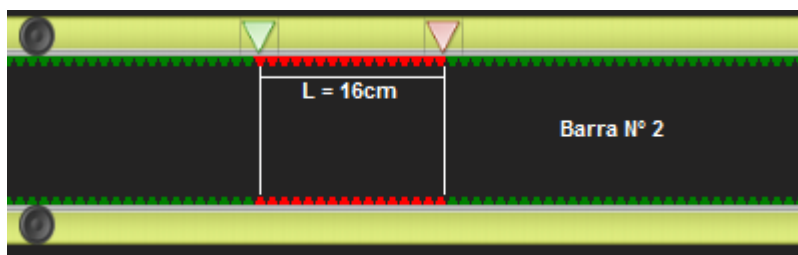


Figura 61 - Measure in cm or inches of the distance between two points

In this view you can also **temporarily delete a series of LEDs for a certain period of time**. Unlike the command <LED Filter> (see chap. 5.4.3), which excludes a series of LEDs for the entire test, this allows you to work also during the test analysis and exclude a series of contiguous LEDs (or one single led) for a certain number of thousandths of seconds. Let's suppose that during a treadmill gait test the athlete has been dragging his foot and that we want to delete the series of LEDs for those 2 seconds: press and hold down CTRL and click on the first wrong led and (without releasing the CTRL and mouse keys), drag it to the second led of the segment (a red area indicates the portion to delete). Confirm pressing YES when asked, if you want to delete the LEDs, and indicate the number of thousandths of seconds for which the change is to be applied (in this example 2000), and the numeric data table will be displayed. Confirm pressing <OK> in the upper left corner, if you want to save the data, or press <CANCEL>.



Figura 62 – Deleting LEDs for a certain amount of time

If you want to delete the whole series of LEDs (a complete footprint) for the entire test, press CTRL+right mouse click on any red led of the footprint and then confirm the deletion pressing YES.

### 5.3.1.5 PRINT

When <Print> is pressed, a multi-page report is printed with the athlete's data, summarizing (average) test data, numerical test data (times, heights, power, etc.) and all the charts of the previous window.

A box containing the index with the pages allows (by clicking on each page) to rapidly select the desired section.

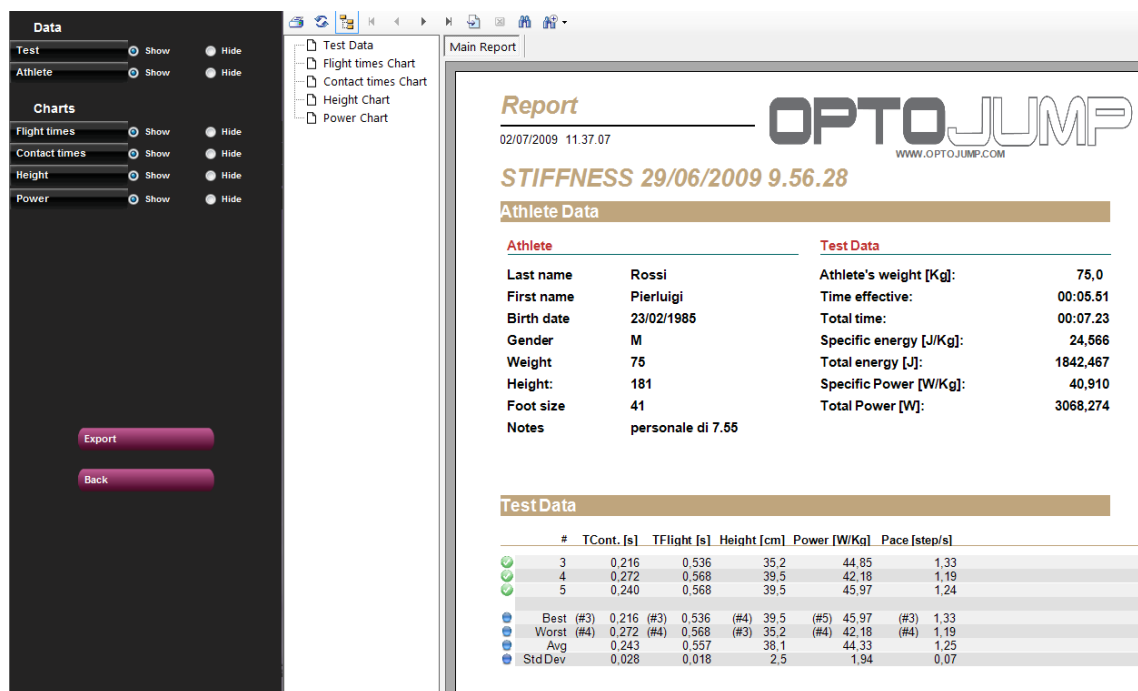


Figure 63 – Report Print

The radio buttons on the left allow to show or hide particular sections of the report for both Data and Charts.

The command toolbar above the report allows to perform the following operations



Figure 64 –Print Report Command Toolbar

- **Prints** the report on the printer set in the dialog box
- **Refreshes** the data
- **Shows/Hides** the page index
- Go to **first** page
- Go to **previous** page
- Go to **next** page
- Go to **last** page
- Go to page **No.**
- **Close** the report
- **Search**
- **Zoom**



The buttons **<Change logo>** and **<Change footer>** allow to customize the report adding your logo and your personal data (they are respectively printed in the top right corner and on the bottom line).

Pressing **<Export>** on the left it is possible to export the report in PDF, Excel, Word or Html format. Choose the desired format from the drop-down menu, select the position, name the file, then press 'Save'.

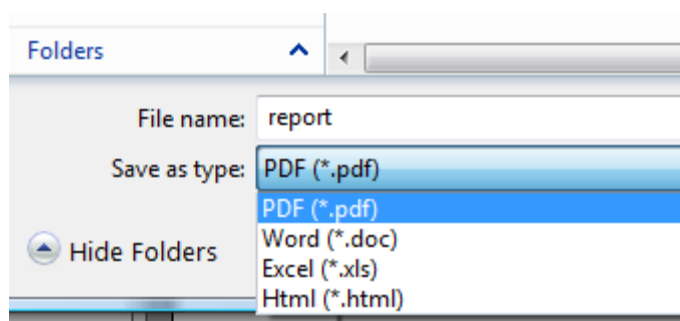


Figure 65 – Dialog box for saving a report

The functionality of Report creation, printing and saving are offered by the external Crystal Report component. If this does not work correctly, we advise you to ensure you have not installed different versions or editions of this software. If you have, uninstall the old versions and re-install the OptoJump Next packet.

#### 5.3.1.6 SAVE ANALYSIS

This function allows to give the current settings configuration a mnemonic name, so that it can be recalled from the list of saved analyses for future use.

#### 5.3.1.7 ANALYSIS NOTES

This function allows to add a note, which will be saved with the analysis. This note (DIFFERENT from a note added immediately after completing the test) will be printed on the bottom line of the report in the provided section, whereas the 'test note' is printed on the first page with the General Data. Warning: the analysis note is saved with the analysis; by not storing it you will lose it.

#### 5.3.1.8 SIGNATURE

The signature works in a way similar to the notes (e.g. 'Mario Rossi, trainer'). The signature is printed on the bottom line of the report and saved with the analysis.

#### 5.3.1.9 PARAMETERS

As explained in chap.5.2.2.1, secondary parameters can be customized for each test based on specific needs.

### 5.3.2 COMPARE

In this section two selected tests are compared. The display structure is similar to the one presented in the previous section. Due to lack of space it is not possible to simulate the bars with the LEDs, which is possible when viewing a single test.

To compare two tests, bring them together in the TEST ANALYSIS table and press <Compare>.

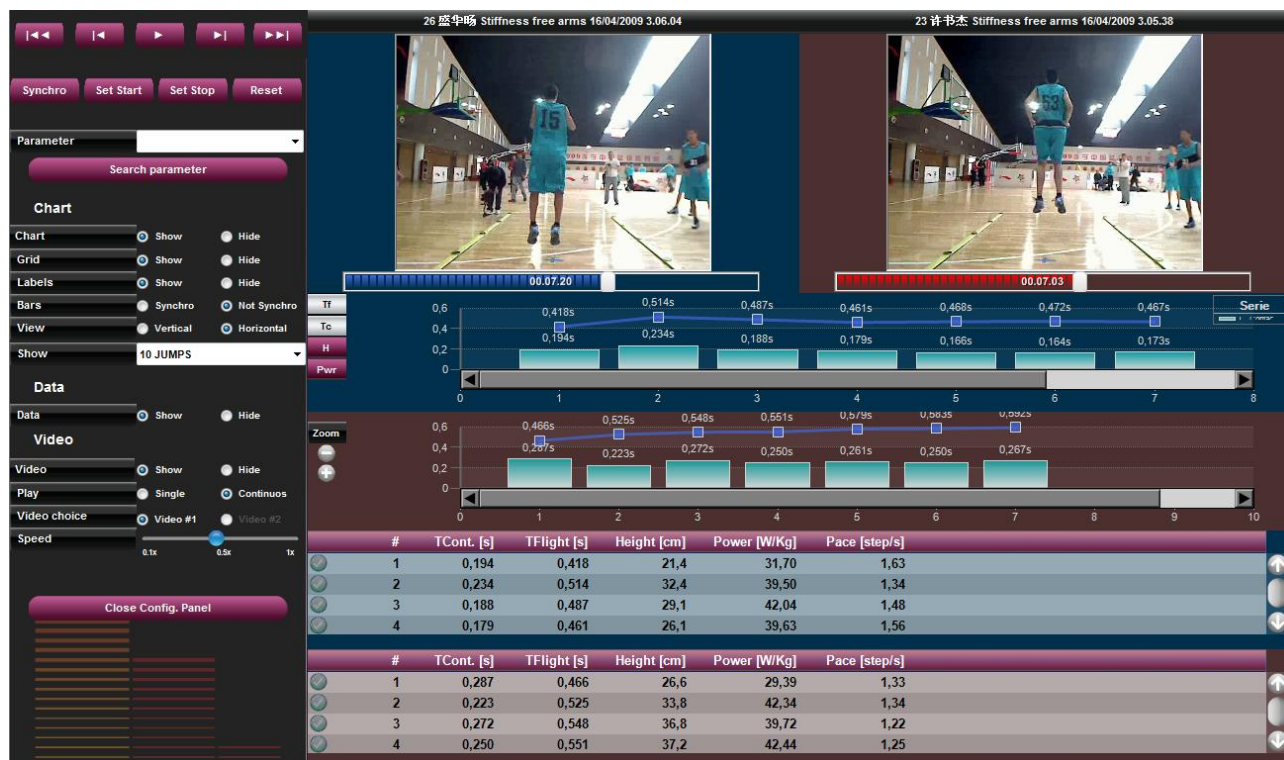


Figure 66 – Compare

Pressing <Play> on the command panel at the top, the two tests (in this example 'Blue Test' and 'Red Test' because of the color of the two sliders below the video) will start running, allowing visual comparison.

The <Configure> button opens an options panel very similar to the one in the previous section (therefore only differences will be described).

The Search Parameter button, allowing to spot a common point (e.g. the first take-off from the ground, called First T.Flight) of the two tests, is very important.

Besides the above-described commands <Set Start>, <Set Stop>, and <Reset>, there is also the <Synchro> command. Pressing this button, the point on which the two tests should be synchronized is set.

Let's make an example: search for the First T.Flight with the command <Search Parameter> and press <Synchro>. Move the cursor of both tests back a little and press <Set Start>, move it slightly forward (after the yellow Synchro marker) and press <Set Stop>.

A range to be analyzed has been set and the two tests will be synchronized on the point of the yellow marker (that is, when the two athletes begin the test).

Another use of the <Synchro> button is to synchronize the two tests on a precise instant (e.g. 10 seconds after the beginning of the test). Set the yellow marker at 10 seconds for both tests; set the start (with <Set Start>) of Red Test at 6 seconds and of Blue Test at 8 seconds. Pressing the play button will play the Red Test only until the 8 seconds are over. At that moment Blue Test starts and the two tests will play in synchronization until the end (or possibly until the point chosen with <Set Stop>).

**NB:** when you press <Synchro>, <Set Start> or <Set Stop>, make sure you have correctly positioned the two tests at the time chosen, as these actions are applied simultaneously to the two tests.

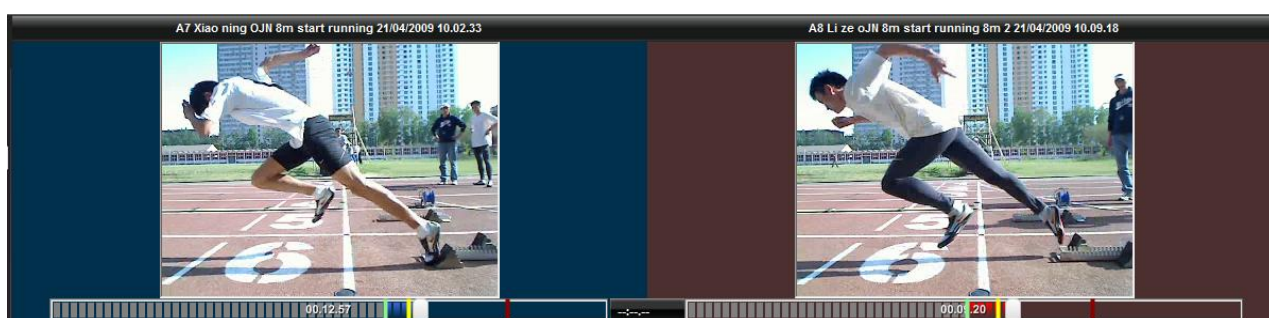


Figure 67 –Synchro, Start, and Stop Settings

Test data viewing can be configured by the user. These settings are similar to those explained in the previous section, except for:

- Chart
  - **View:** data can be viewed horizontally (as in Figure 66 – Compare
  - or vertically. In the latter case the numerical values are scrolled horizontally.
  - **Bars:** synchronization of the bars means that if, for example, the Blue Test time slider is moved, the red bar for the Red Test time is automatically moved, too. If 'No Synchro' is chosen, the two scroll bars are disconnected and can be moved independently from each other.
- Video
  - **Video choice:** if two movie clips have been acquired i.e. two webcams are connected, for each test it is possible to choose which movie clip to view, 'Video#1' or 'Video#2'. It is not possible to view the Video taken by Webcam#1 for Blue Test and that by Webcam#2 for Red Test (or vice versa).

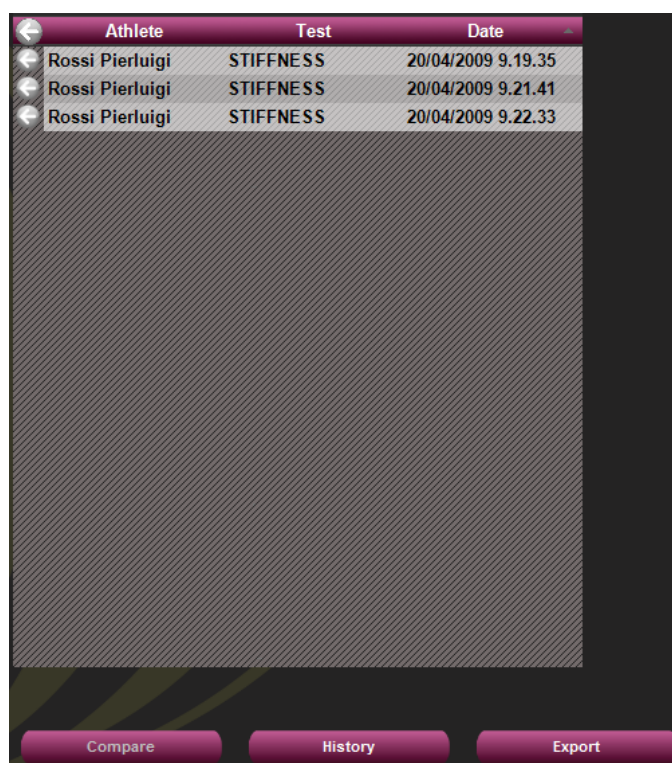
### 5.3.2.1 PRINT, ANALYSIS, NOTES, SIGNATURE

The options are mainly the same as in the 'View' section. Printed data is obviously that of the comparison between the two tests, therefore the name of the test, the values, and charts refer to is always displayed at the top.

### 5.3.3 HISTORY

The History section allows to analyze the progress made by an athlete by graphically and numerically analyzing a series of tests. Or it can be used to analyze the team members comparing them using the same test type.

Select two or more tests (generally of the same type or in any case uniform in order to have plausible data) and press <History>. It is possible to decide first the sequence to view the progress in (usually chronological from the oldest to the newest) clicking on one of the column headers (e.g. Date) and then clicking on the <History> button.



Athlete	Test	Date
Rossi Pierluigi	STIFFNESS	20/04/2009 9.19.35
Rossi Pierluigi	STIFFNESS	20/04/2009 9.21.41
Rossi Pierluigi	STIFFNESS	20/04/2009 9.22.33

Compare History Export

Figure 68 –History analysis of three tests ordered by date

Pressing <Configure> allows to choose which value to take into consideration for progress analysis: it is possible to select one of the number of jumps or the average, best, worst or standard deviation value.

If the tests had a defined starting foot, it is possible to view the data and progress graphs for only one foot or the difference of both feet.

Clicking on the column headers data are ordered by measure and the graph is updated; this is very useful, for example to order the team members from the worst to the best value of any parameter (e.g. from the slowest to the fastest in a 12 m sprint test).

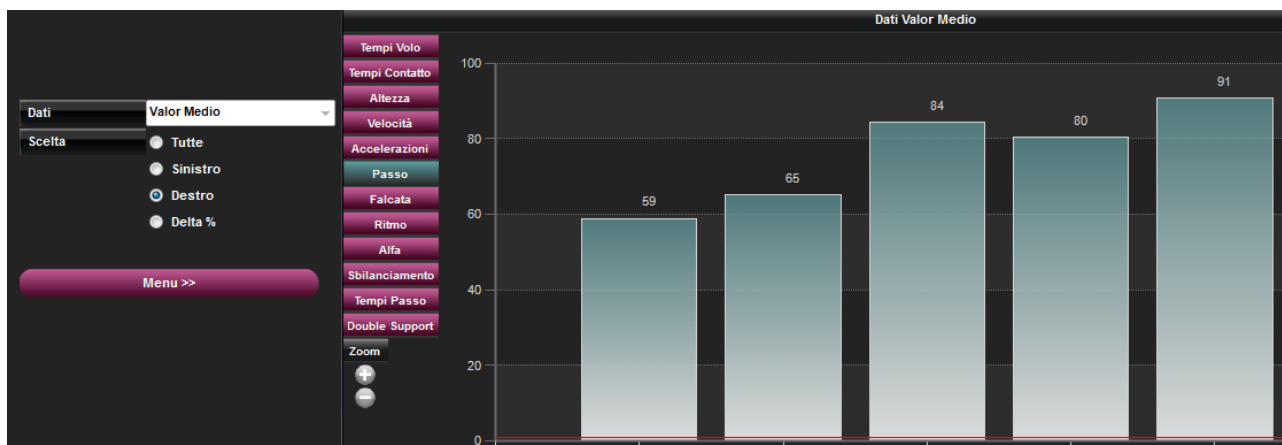


Figure 69 –History of the left foot step length of an athlete

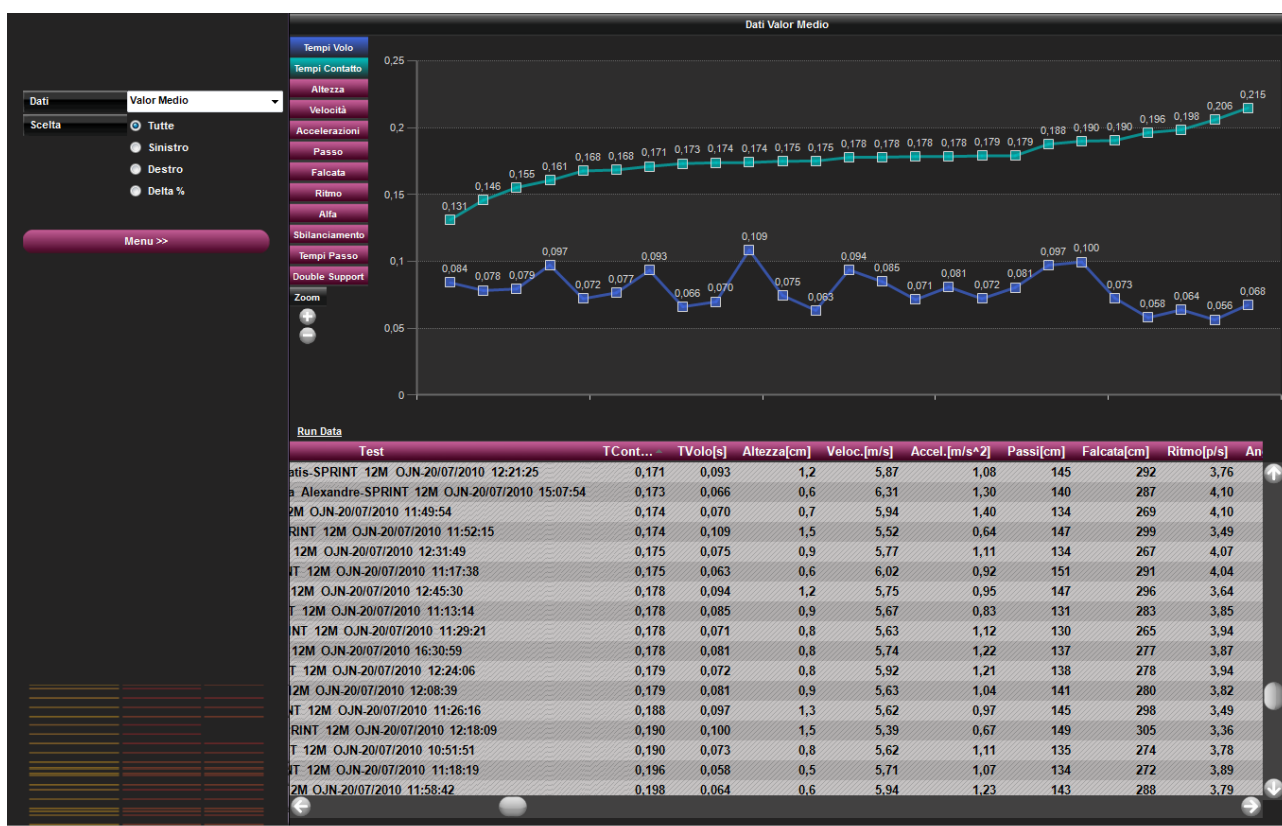


Figure 70 – Team analysis; tests ordered by contact time, from the best to the worst

The <Print> option allows to create a report to be printed or exported in pdf, Excel, Word or Html format.

### 5.3.4 EXPORT

To export data of one or more tests to Excel, add at least one test to the 'TEST ANALYSIS' table and press <Export>. You are asked whether you want the extended version (for each row of data the test heading and the athlete's data is repeated – this is useful for pivot tables) or the simple one (only numerical data for the test).

	A	B	C	D	E	F	G	L	M	N	O	R	S	U	V	W
1	Cognome	Nome	DataNascita	Sesso	Peso	Altezza	Piede	Test	Data	#	TEsterno	TVolo	TContatto	Altezza	Potenza	Ritmo
2	Rossi	Pierluigi	23/02/1985	M	75	181	41	SQUATJUMP	07/02/2009 11.12	1		0,511		32		
3	Rossi	Pierluigi	23/02/1985	M	75	181	41	SQUATJUMP	04/03/2009 16.17	1		0,568		39,6		
4	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	1		0,552		37,4		
5	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	2		0,576	0,288	40,7	41,56	1,16
6	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	3		0,56	0,264	38,5	42,06	1,21
7	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	4		0,528	0,272	34,2	37,37	1,25
8	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	5		0,656	0,288	52,7	51,68	1,06
9	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	6		0,384	0,28	18,1	21,9	1,51
10	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	7		0,56	0,344	38,4	35,37	1,11
11	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	8		0,52	0,336	33,2	31,86	1,17
12	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	9		0,736	0,376	66,4	52,33	0,9
13	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	10		0,656	0,2	52,7	67,49	1,17
14	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	11		0,56	0,248	38,4	43,85	1,24
15	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	12		0,696	0,288	59,4	57,2	1,02
16	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	13		0,648	0,256	51,5	55,02	1,11
17	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	14		0,608	0,312	45,3	43,11	1,09
18	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	15		0,696	0,264	59,4	60,85	1,04
19	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	16		0,584	0,264	41,8	45,09	1,18
20	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	17		0,616	0,288	46,5	46,48	1,11
21	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	18			0,24			
22	Rossi	Pierluigi	23/02/1985	M	75	181	41	BALZI 15 SEC.	14/04/2009 9.44	Esterno	0,056					
23	Rossi	Pierluigi	23/02/1985	M	75	181	41	SQUATJUMP	20/04/2009 16.43	1		0,432		22,9		
24	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	1		0,294	0,226	10,6	16,28	1,92
25	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	2		1,922	0,12	453	789,53	0,49
26	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	3		0,104	0,102	1,3	5,06	4,86
27	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	4		0,128	0,088	2	7,49	4,63
28	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	5		0,104	0,096	1,3	5,21	5
29	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	6		0,192	0,096	4,5	13,85	3,47
30	Rossi	Pierluigi	23/02/1985	M	75	181	41	STIFFNESS	30/04/2009 16.41	7		0,224	0,096	6,1	17,95	3,13

Figure 71 –Export result in Excel with the Extended version



## 5.4 UTILITY

### 5.4.1 BASIC SETTINGS

The Basic Configuration section includes the following items:

#### 5.4.1.1 GENERAL

- **Language:** the language can be changed at any moment during the execution of the program. Select the desired language from the drop-down menu and press <Save>
- **Unit of Measurement:** allows to set the unit of measurement type for viewing test output values. In particular:

Type	International	US/UK
Height	cm	inch.decimal
Power	W	W
Specific power	W/kg	W/kg
Steps	cm	ft, inch.decimal
Speed	m/s	ft/s
Acceleration	m/s <sup>2</sup>	ft/s <sup>2</sup>
Weight	kg	lb
Energy	J	J
Specific energy	J/kg	J/kg
Distances	cm	yards, ft, inch.decimal
Step & Stride	cm	ft, inch.decimal

Table 1 - Units of Measurement

#### 5.4.1.2 JUMP TEST CONFIGURATION

The flight and contact time configurations include:

- **Minimum contact time [ms]:** allows to set a minimum contact time in milliseconds; if the contact time is shorter, it is considered incorrect; so if the system registers a contact time shorter than this value, the time is added to the associated flight time (usually the previous one). This control can be enabled/disabled by inserting the value 0.
- **Minimum flight [ms]:** allows to set a minimum flight time in milliseconds; if the flight time is lower, it is considered incorrect; if the system registers a flight time shorter than this value, the time is added to the associated contact time. This control can be enabled/disabled by inserting the value 0.
- **Maximum flight time [ms]:** allows to set a maximum flight time in milliseconds; if the flight time is higher, it is considered incorrect. This is for example useful for a 'round

trip' test, where the athlete exits the measurement area, turns around and enters it again. The time for changing direction would be considered an abnormal flight time; this parameter allows to prevent this.

### 5.4.1.3 REACTION TEST CONFIGURATION

Reaction time configurations include:

- **Reaction time range [ms]:** indicates the time frame in milliseconds within which the reaction signal must be given randomly.
- **Acoustic signal type:** allows to choose whether to generate the acoustic signal using the sound card, which may not be present, or the internal loudspeaker generally always available in personal computers.

### 5.4.1.4 VIDEO

After connecting the webcam(s) to the PC USB port and installed the drivers, the video camera can be tested. Under the heading 'Video', select a Logitech webcam from those available and press <Test>. The choice of webcams has been limited only to high-range Logitech webcams to prevent synchronization problems between OptoJump Next and video data. Webcams by other manufacturers are displayed in gray.



Figure 72

#### 5.4.1.4.1 Video Test

After pressing <Test> the webcam configuration panel in basic mode with the commands for changing gain and exposure (shutter time) is displayed. For better quality and fluidity of videos we recommend using a brief exposure time, such as 1/100 or 1/200, and then adapting gain to obtain the correct image exposure (neither too bright nor too dark). We also recommend not to set 'Auto' to prevent slowing down the movie clip acquisition.

With <Device> you can recall the control panel of the webcam's standard driver, whereas <Default> sets the standard value pre-defined by the manufacturer.



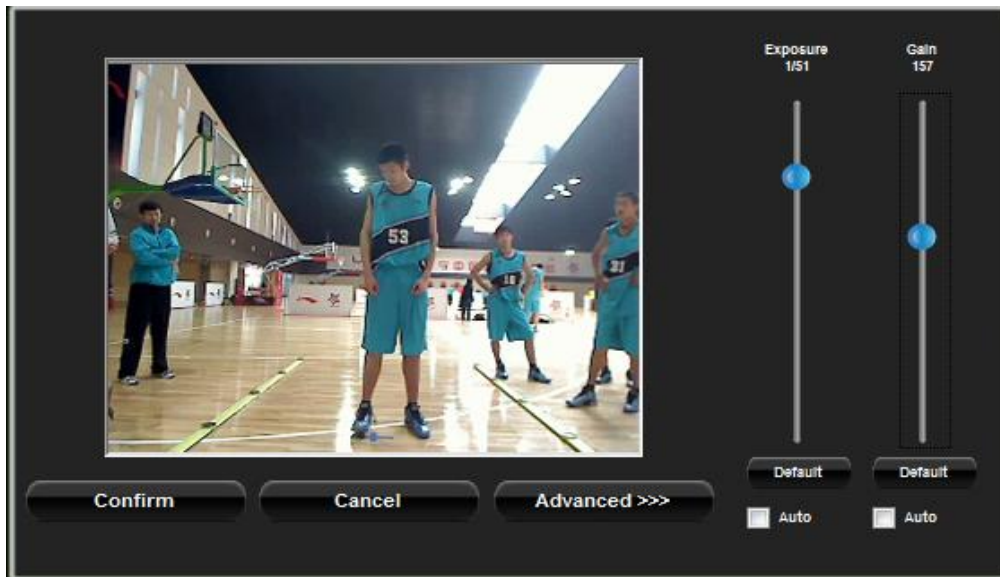


Figure 73– Basic Panel for Webcam configuration

Pressing the <Advanced> button other commands are displayed.

- **Zoom** allows to apply a digital zoom via software
- **Contrast, Brightness, Saturation, Sharpness** allow to adapt the image; it is advisable to move the corresponding cursor to test the effects of the command.
- **White Balancing** is useful when working in closed rooms with very warm lights (tungsten, which gives a yellowish hue) or very cold lights (neon, which gives a bluish hue). You should frame a sheet of white paper or something neutral and then remove any dominant colors using the cursor.
- **Focus** allows to focus manually in those rare cases when the autofocus does not work.



Figure 74– Advanced Panel for Webcam configuration

Remember to save changes by pressing <Confirm>.

Other video-related configurations are:

- **End of time video acquisition [s]:** this is the time between the end of the test and the end of video acquisition (i.e. a certain number of extra seconds are recorded after the end of the test).
- **Acquisition Format:** allows to choose the format for saving videos, which can be in **ASF** (more compact and compatible with Windows Media Player) or **AVI** (compatible also with other players but less efficient compression).

#### 5.4.1.5 SPRINT/GAIT TEST CONFIGURATION

The configurations of this test type include:

- **Direction of entry:** allows to indicate if the Running/Gait entry direction is from the 'interface side' (drum) or from the 'opposite side'. If 'automatic' is chosen, OptoJump Next automatically calculates the direction, considering the LED nearest the center of the foot as the beginning of the LEDs.
- **Test timeout [ms]:** this is the test end timeout in milliseconds; if during a test with 'Timeout' stop type no input or output signal is received from the measurement area by the OptoJump device for a period longer than or equal to the time set here, the test is considered completed.
- **External signal holdoff [ms]:** is the holdoff time between two consecutive external signals. Caution has to be applied for this value, because it may depend on the type of test being carried out
- **Step length calculation:** allows to choose whether to calculate step length as the distance between the tips of two successive feet or as the distance between the heels of two successive feet.

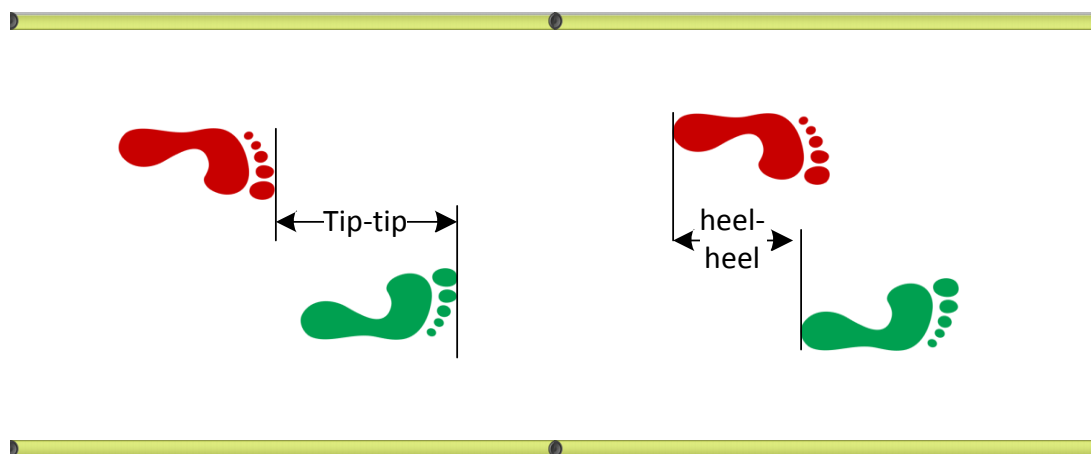


Figure 75 - Tip to Tip or Heel to Heel Step Length

- **Minimum Step Length [cm or ft]:** is the minimum step length in centimeters (or feet), used as a basis to calculate the step length for a Run/Gait test.
- **N° step speed reference:** insert the reference speed for the 3rd / 6th / 9th step in m/s; insert 0 to disable this option.
- **Split N° at distance [cm or ft]:** insert at how many cm from the start the first or second split time will be taken; leave 0 to disable split times.

- **Minimum foot length [cm]:** is the minimum foot length in centimeters (or inches) used to filter possible wrong acquisitions.

#### 5.4.1.6 SCREEN

The OptoJump Next software works on most desktop PCs and notebooks of the most recent generation, usually with a resolution of 1024x768 (which is the minimum recommended resolution). For users who desire to use computers with lower resolutions (such as for example netbooks which very often have 1024x600) or computers with lower performance, we recommend to select the **'Reduced' Screen** option; this will apply the following changes:



- In the tables with numerical data and the data lists, a smaller font is used in order to fit as much information as possible without having to scroll too much.
- In the Test|Execute module, the webcam, though connected, is not displayed in real-time during acquisition, but the video is in any case saved and can be played in the module 'Results'.
- In the module Results|View or Compare Test it is not possible to view charts and the table with numerical data simultaneously (either one or the other); furthermore, the bar display is disabled. In the configuration panel, the VCR Player control for the video is hidden.

#### 5.4.1.7 NEWS & EVENTS

As described in chap. 3, when the software is launched, a series of news and events are displayed on the homepage, which are updated in real-time via the website [www.optojump.com](http://www.optojump.com). If the computer is not connected to the Internet, the detection of missing connectivity may take a few seconds. For PCs that are permanently disconnected from the Internet (e.g. fixed stations on the training field without Internet) it is useful to disable the updating of news and events, to prevent the updating timeout.



### 5.4.2 OPTOJUMP (ONLY FOR NON-NEXT HARDWARE)

After having enabled the use of the software with bars of the previous model, it is possible to set the serial port for system connection and, if applicable, the serial port for connecting Racetime2 for data download.

### 5.4.3 OPTOJUMP HW TEST

In this section the connected hardware (OptoJump Next bars and/or webcam) can be checked. Opening the function, if the webcam (or both webcams) is (are) connected, the live image should be displayed. If one or both images do not appear, check that they have been selected in the Basic Configurations | Video or drivers have been installed correctly.

To check the connection with OptoJump bars, press <Execute> to start the test. The test continues until <STOP> is pressed.

If there are no interrupted LEDs, the test ends with a positive result.

The test can now be repeated by pressing <Execute> and interrupting the LEDs manually, for example, by putting a foot between the bars. Please note that some LEDs turn red indicating interruption of the signal caused by entry of the foot. If <End> is pressed, the software will show the interrupted LEDs in the table below, indicating that the test has not had a positive result, because of this intentional interruption.

This test is also very useful to check (mainly in case of outdoor installations of long bar combinations) if there are obstacles, like leaves, stones, hills, etc. between the transmitting and the receiving bar. If the obstacle cannot be removed, it is possible to exclude it via the software: in this case, all interruptions of those LEDs will not be taken into consideration for the test. The picture below shows for example LED no. 66-68 of bar #1, which has been interrupted with the request to exclude it from acquisition.

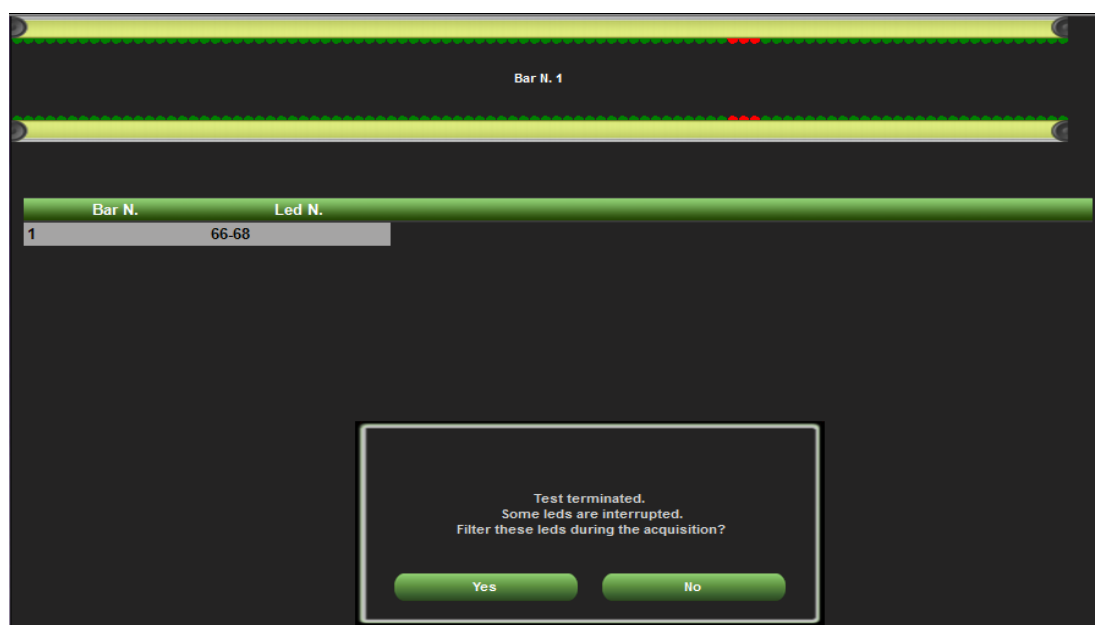


Figure 76 - Excluding an interrupted LED

If you reply YES, next time when using this function, the excluded LED will be BLUE and the button in the lower right corner, <Active LED filter>, will indicate that one or more LEDs have been excluded from the acquisition (the same button appears every time a new test is performed). Pressing the button, the filter can be removed and all LEDs of this bar can be taken into consideration again.

#### 5.4.4 DATABASE

OptoJump Next stores all data (athletes, tests, results, settings, etc.) in a database file (Sql Server CE format with the extension .SDF). Most users can use a single file to store all information, which by default will be called 'OptojumpNext.sdf', and located in the following directory:

%appdata%\Microgate\Optojump Next

The name of this directory changes depending on the operating system used and the language, but typing it in the address bar of an Explorer window will open the correct folder. Some examples follow (<YourUserName> is the user name for logging into Windows):

**Windows XP in Italian:** C:\Documents and Settings\<YourUserName>\Dati Applicazioni\Microgate\OptoJump Next

**Windows XP in English:** C:\Documents and Settings\<YourUserName>\Application Data\Microgate\OptoJump Next

**Windows VISTA/7 :** C:\Users\<YourUserName>\AppData\Roaming\Microgate\OptoJump Next  
etc.

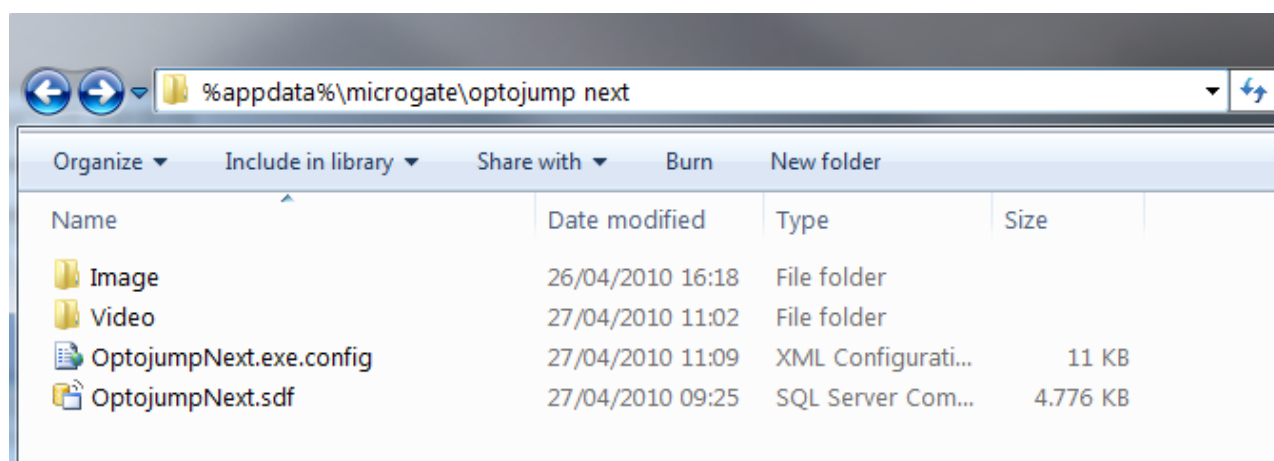


Figure 77 - Folder where by default all database, settings, video, and image files are located

The subdirectory VIDEO contains the videos (in .asf or .avi format depending on your choice in 5.4.1.4) acquired by the webcam, whereas in IMAGE all still pictures are stored (.bmp files with possible graphical notes) saved via the module Video Analysis.

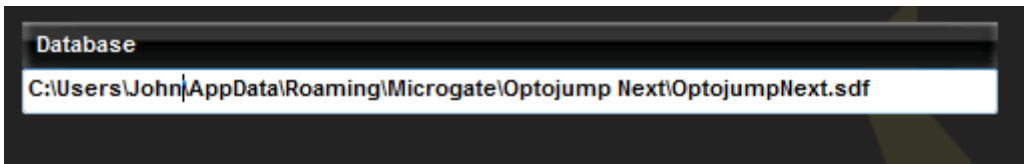
The software makes it possible to handle more databases (one at a time) for particular needs: for example, the trainer of a team, who wants to separate the tests of one season from those of another one (warning: in this case he will not be able to do any comparisons or analyze the history), or a free-lance professional, who does tests for various customers, can create a database for every team to be tested.

It is also possible to export database data in a compact format (one single file containing database, videos, and images) to transfer them from one PC to another or to hand them to the customer to review them with the software that can be downloaded for free from the website [www.optojump.com](http://www.optojump.com).

The commands used for these purposes are the following:

#### 5.4.4.1 CURRENT DATABASE

The path indicates which database is used; the commands below, <New> and <Select>, allow to edit the directory and the file to use.



#### 5.4.4.2 NEW

Creates an EMPTY database and sets it as current; you will be asked in which folder to place it.

#### 5.4.4.3 SELECT

If more than one database has been created, you can choose (browsing on the hard disk) which one to be the ACTIVE one.

#### 5.4.4.4 CLEAR

Empties the current database from all Athletes, Groups, Test Definitions, and Tests (tests, protocols, analyses) data. You will be asked which of the four tables to empty and further confirm (this operation is IRREVERSIBLE and cannot be undone).

#### 5.4.4.5 IMPORT PREVIOUS

Allows to import the database of the previous HW/SW version. You will be asked to locate the .opj file saved with the old software.

#### 5.4.4.6 EXPORT

Exports the CURRENT database together with all videos and still pictures processed in a single compressed file with the extension .OJN; you will be asked in which directory (or on which drive, for example a USB stick with sufficient space) to create and store the file and how to name it. It is possible to export only the database, without videos and images, choosing 'Database (\*.sdf)' from the File Type dropdown menu.

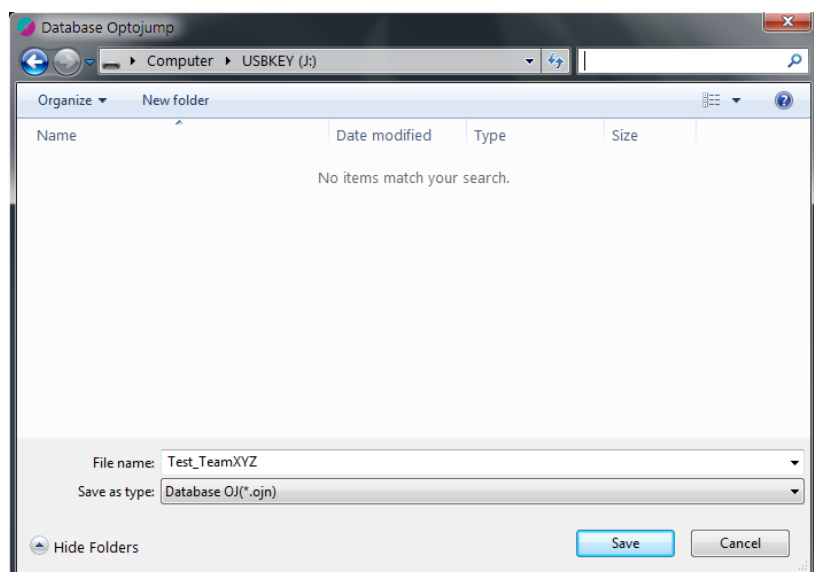


Figure 78 - Saving the OJN file

#### 5.4.4.7 IMPORT

Imports an .OJN file previously exported to another PC or to the same PC, in case of data deletion or removal (restore). This command can also be used to merge two databases in one database.

This operation is carried out in THREE steps:

- You will be asked, if you want to import into a new database (Import) or in the current one (Merge)
- The first dialog box asks to locate the file with the extension .OJN to import
- The second dialog box (only if you clicked YES in the first message window) asks in which folder to extract the .ojn file and as a consequence to store the database file (.sdf) and its subdirectories Video and Images. It is recommended to use the suggested default destination directory, which is the local %appdata% folder.

**Example:** You want to import an .ojn export file saved on a USB stick extracting its files to the folder 'C:\My Optojump Test':

Press <Import>, browse to the drive of the USB stick (in the following example J: ) and select the file Test\_TeamXYZ.OJN double clicking on it:

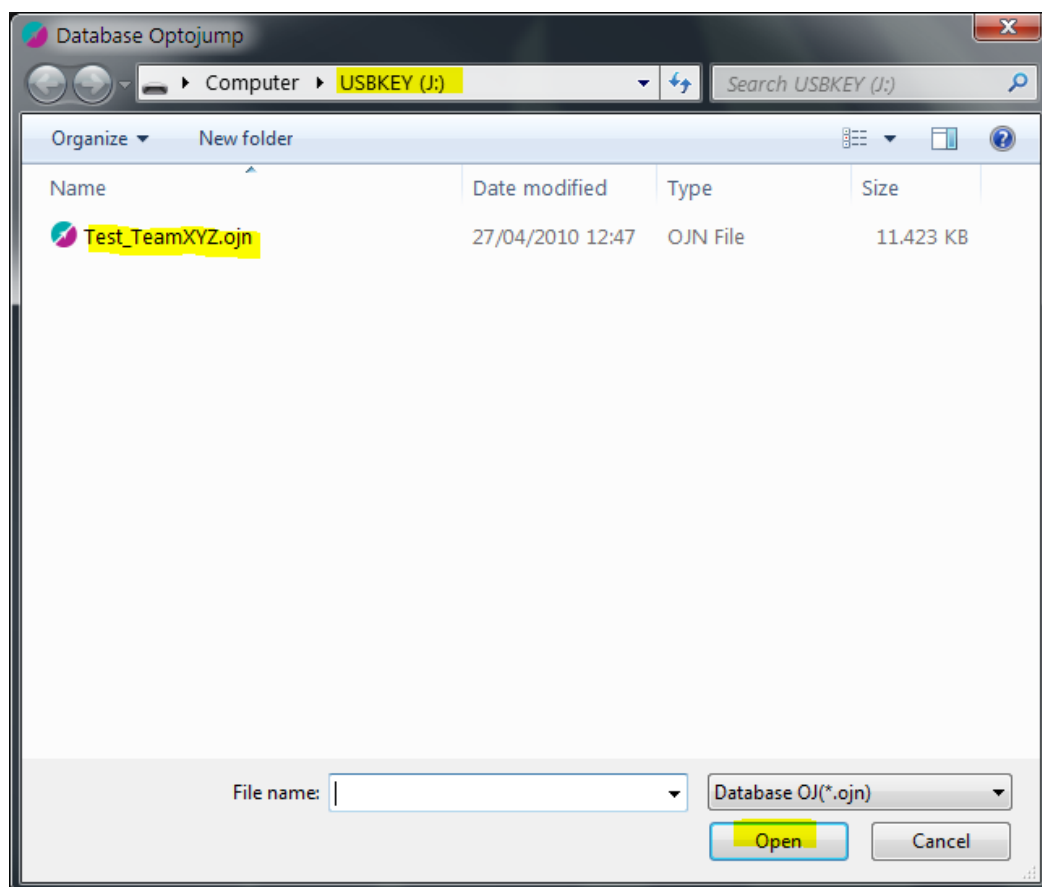
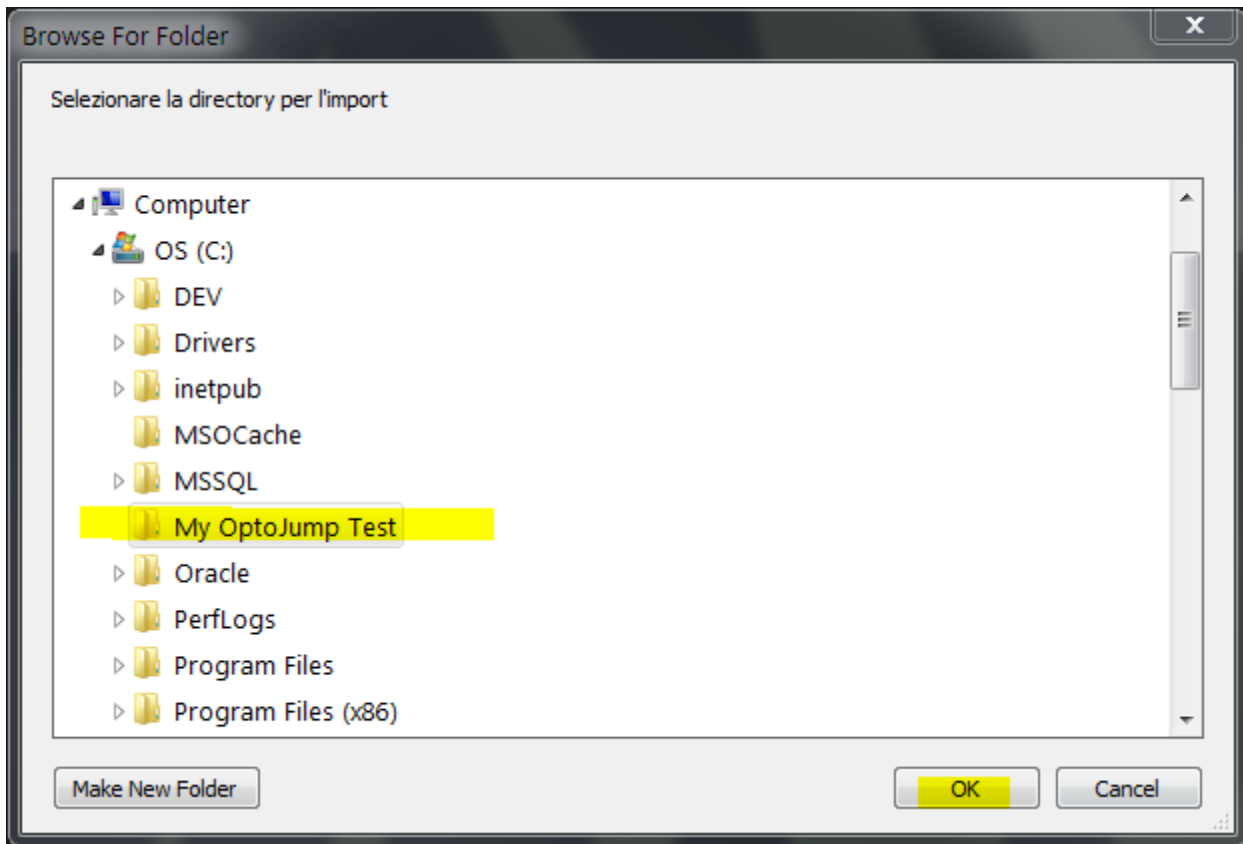


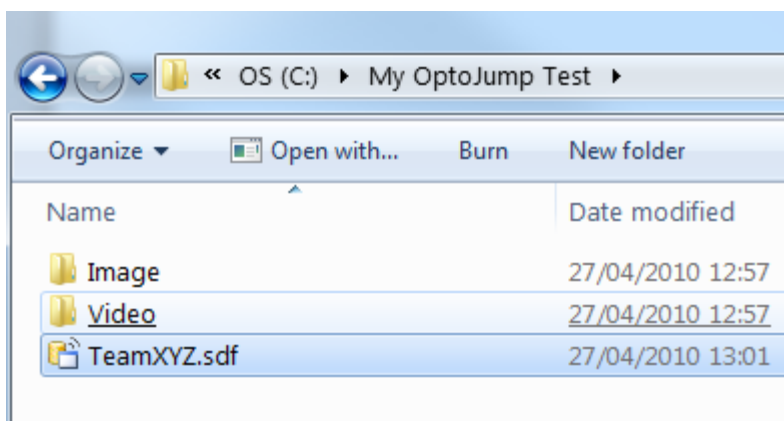
Figure 79 - Choosing the OJN file to import



Now choose the directory for the import; if not present, create it on the fly using <Make New Folder>.



The selected folder will contain the extracted files



The database is automatically set as current, as you can see in the relevant field:



#### 5.4.4.8 SAVE AS

This command allows to DUPLICATE the CURRENT database. This can be useful for backups or e.g. to have a copy of the database in which to keep the data of Athletes and Groups, but where you do not want test data (e.g. when beginning a new season). You will be asked in which directory to store the file and to name it. ATTENTION: Unlike the command Export Database(\*.sdf), 'Save as' saves the sdf file, but also the videos and the still images.

#### 5.4.5 CHECK UPDATE

This checks if the installed version is the most recent one. If not, OptoJump Next suggests to download the newest version from the site.

**NB:** before pressing <Check Update> check that the Internet connection is active.

#### 5.4.6 ABOUT

This section displays respectively:

- Hardware and software characteristics of the computer
- Version of the OptoJump Next software and of the video component
- Version of the OptoJump Next bars, LED definition (10 mm or 30 mm) and system structure (number of bars in X and Y)

If our Support Team asks you to provide this data, select the whole field with the cursor, right-click on it and select COPY. Then send an e-mail in which you PASTE the copied data.

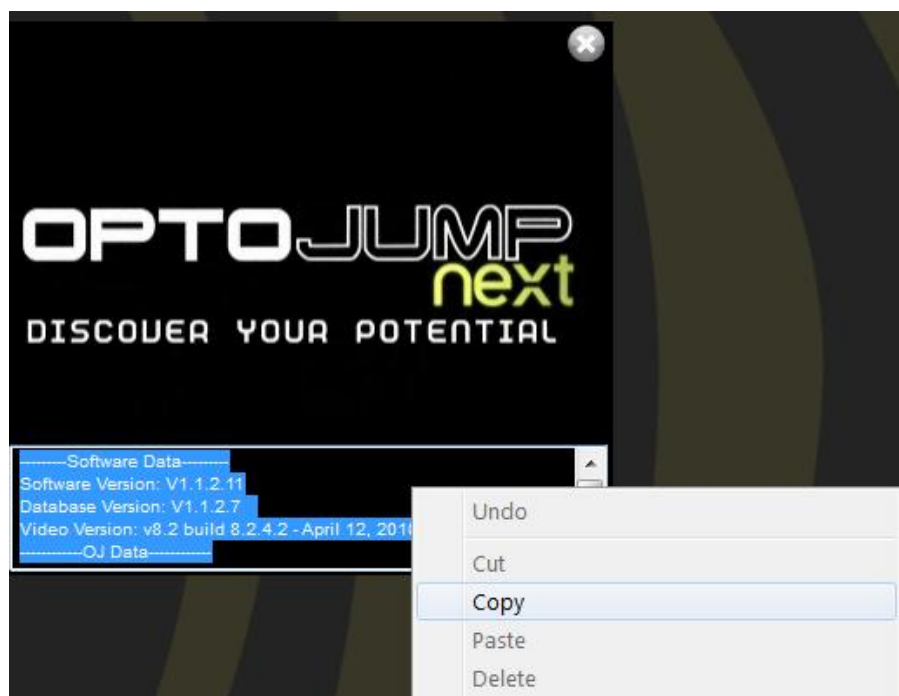


Figure 80 - About window showing the technical data for the Support Department

## 6 OPERATING PRINCIPLES

### 6.1 DEFINITION OF RESULT COLUMNS

#### General information

- **Column #:** contains information on the various row types. The following values are possible
  - **External:** row with a time generated by an external or end of test signal with a timeout or end of time
  - **1,2,...no. (progressive number):** valid row. Each row represents a jump and can contain a contact + flight/step time or only flight/step time
  - **Averages:** average values for the various columns; the average is not calculated for all columns; it is calculated using only the times of valid rows (indicated with a progressive number)
  - **Std:** standard deviation of the column compared to the average, the standard deviation is not calculated for all columns
  - **Interrupted:** if a test is interrupted prematurely by the user, the test finishes with this warning message
  - **Error:** in a reaction test, if single repetition fails this is signaled with Error
  - **Deleted:** row with contact and/or flight/step times deleted from displays and calculation of average and total values (see Management of invalid times for more details)
  - **Tc not valid:** row with invalid contact time; contact + flight/step times for this row are therefore added to the flight/step time of the row above (see Management of invalid times for more details)
  - **Tf not valid:** row with invalid flight time; contact and/or flight/step times for this row are therefore added to the contact time of the line below (see Management of invalid times for more details)
  - **No step:** in a running/gait test, when the number of steps acquired is lower than the number of rows with contact + flight times, excessive rows are signaled like this;
  - **Suspended:** indicates that a treadmill type test was suspended for a certain time and then resumed, the suspension time;
  - **Split:** time passed from the Start to the reception of an external split signal, valid only for running/gait tests;

### Jump and Reaction Test

- **TCont. [s]:** Contact times
- **TFlight [s]:** Flight times
- **Height [cm or in]:** Height of jumps calculated with the following formula

$$h = \frac{T_v^2 \cdot g}{8}$$

- **Power [W/kg]:** Expressed power calculated with the following formula

$$P = g^2 \cdot T_f \cdot \frac{(T_f + T_c)}{4 \cdot T_c}$$

*g=gravity acceleration,  $T_f$  = Flight Time,  $T_c$  = Contact Time*

- **Rhythm [p/sec]:** Rhythm expressed in jumps (or steps) per second
- **Centroid[cm]:** This is the distance between the beginning of the bar (drum) and the middle support point. In the case of jumps with both feet perpendicular to the bars, it will show where the center of gravity is.
- **Centroid Distance[cm]:** Distance between the current centroid and the previous centroid, i.e. how much the centroid is displaced with respect to the previous jump. A value = 0 indicates the perfect repeatability of a jump (useful mainly for one-leg jumps), negative values indicate a displacement towards the drum (to the left for example), positive values displacements in the opposite direction (to the right in this figure); in jumps with feet parallel to the bars indicate forward/back displacements.
- **Occupied area[cm]:** Difference in cm between the first and the last activated LED; indicates how much the legs are apart.

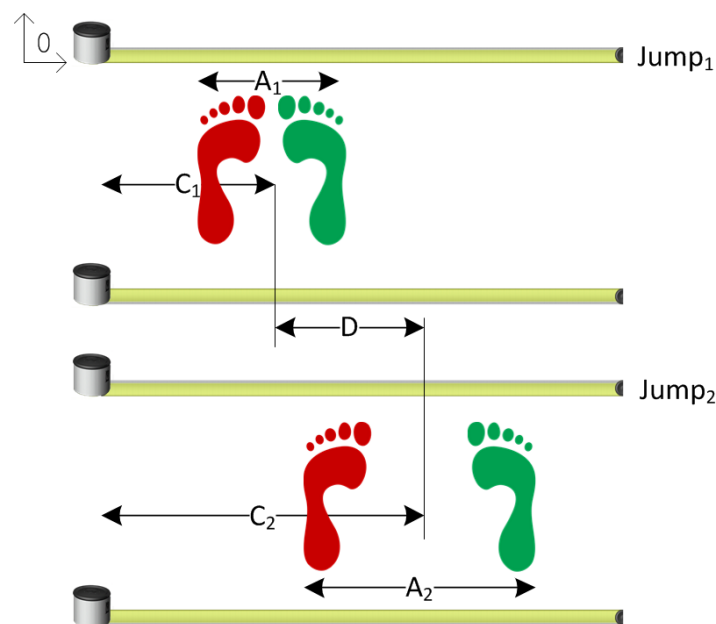


Figure 81 -Centroid Example (C), Centroid Distance (D), and Occupied Area (A)

### Sprint/Gait Test

The following are some useful definitions to explain the values displayed on the table with numerical data.

**Step:** the distance between the tip (toe) of two subsequent feet or the distance between the heel of two subsequent feet depending on the settings in the parameter 'Step length calculation' (see chap. 5.4.1.5).

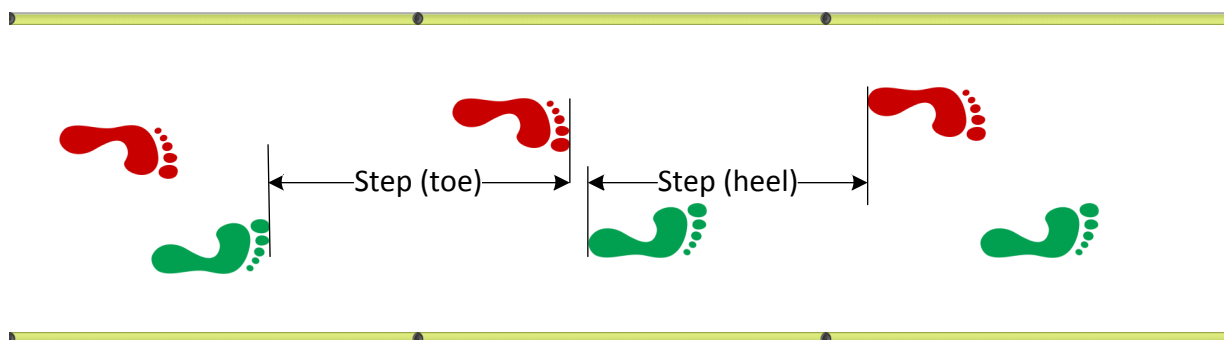


Figure 82 - Step definition

**Stride:** the distance between the tip of two subsequent footprints of the same foot or the distance between the heel of two subsequent footprints of the same foot depending on the settings in the parameter 'Step length calculation' (see chap. 5.4.1.5).

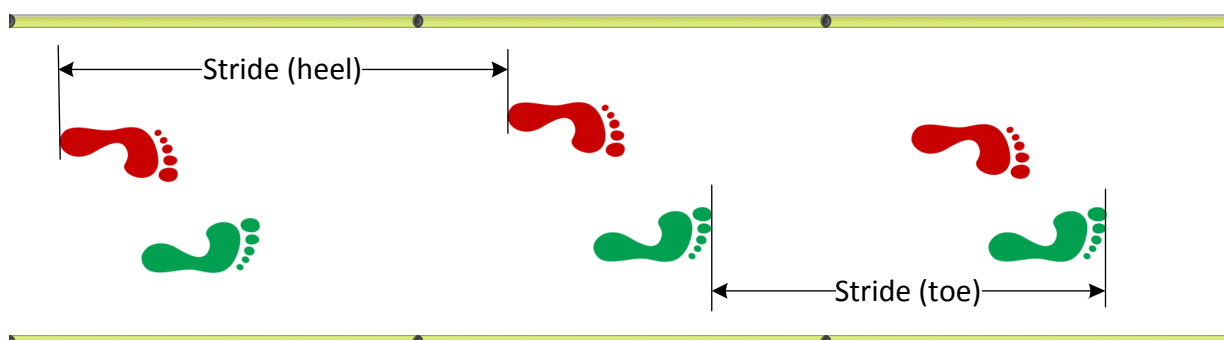


Figure 83 - Stride definition

**Speed:** is the relation between the distance between the two feet and the sum of the first Contact time ( $T_c$ ) and the Flight time ( $T_f$ ).

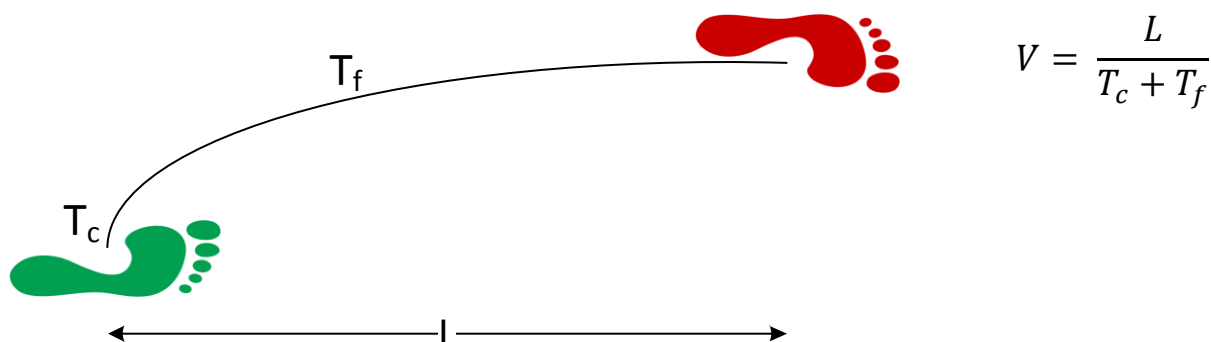


Figure 84 - Speed calculation

**Acceleration:** is calculated as the relation between speed delta of the two steps and the sum of the contact and flight time.

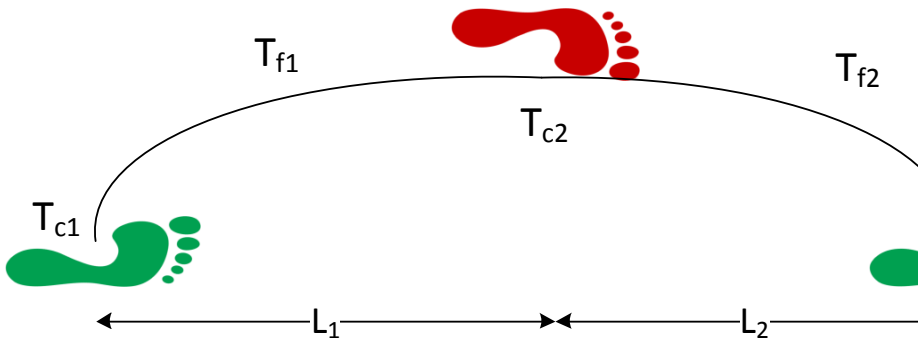


Figure 85 - Acceleration calculation

$$a = \frac{V_2 - V_1}{T_{c1} + T_{v1} + T_{c2} + T_{v2}}$$

**Stride Angle:** This is the angle of the parable tangent deriving from the movement of a stride (L=stride length, h=height to which the foot is risen).

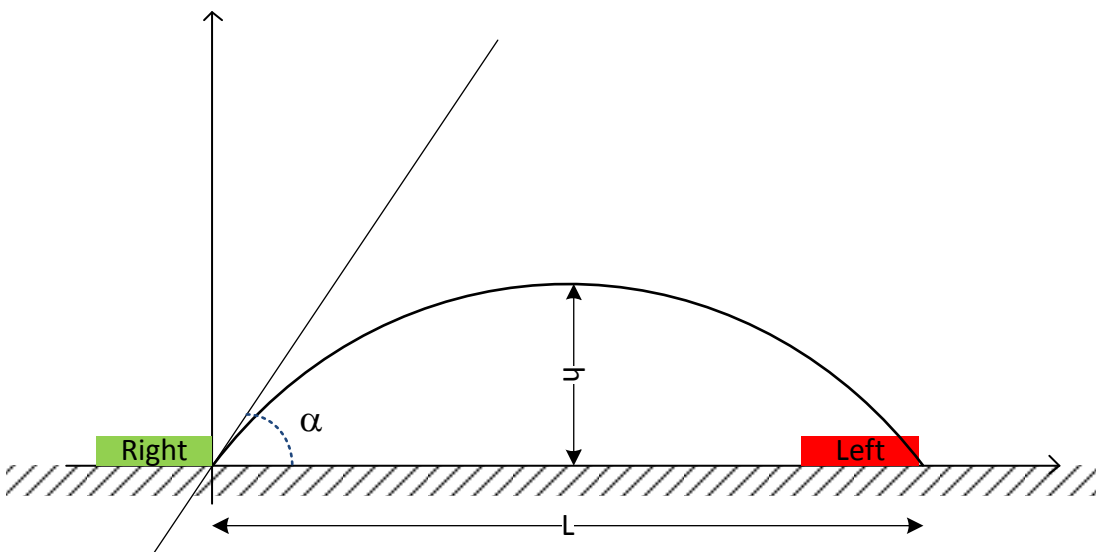


Figure 86 - Stride angle

## Gait Analysis Definition

*Note: The names of these measurements are used in English also in other locales, because the English terms are standard technical Gait Analysis terminology. Terms such as Single Support, Double Support, Stance, Swing, etc. are well known among professionals, therefore these terms are not translated in any language.*

The following are some useful definitions to explain the values displayed on the table with numerical data.

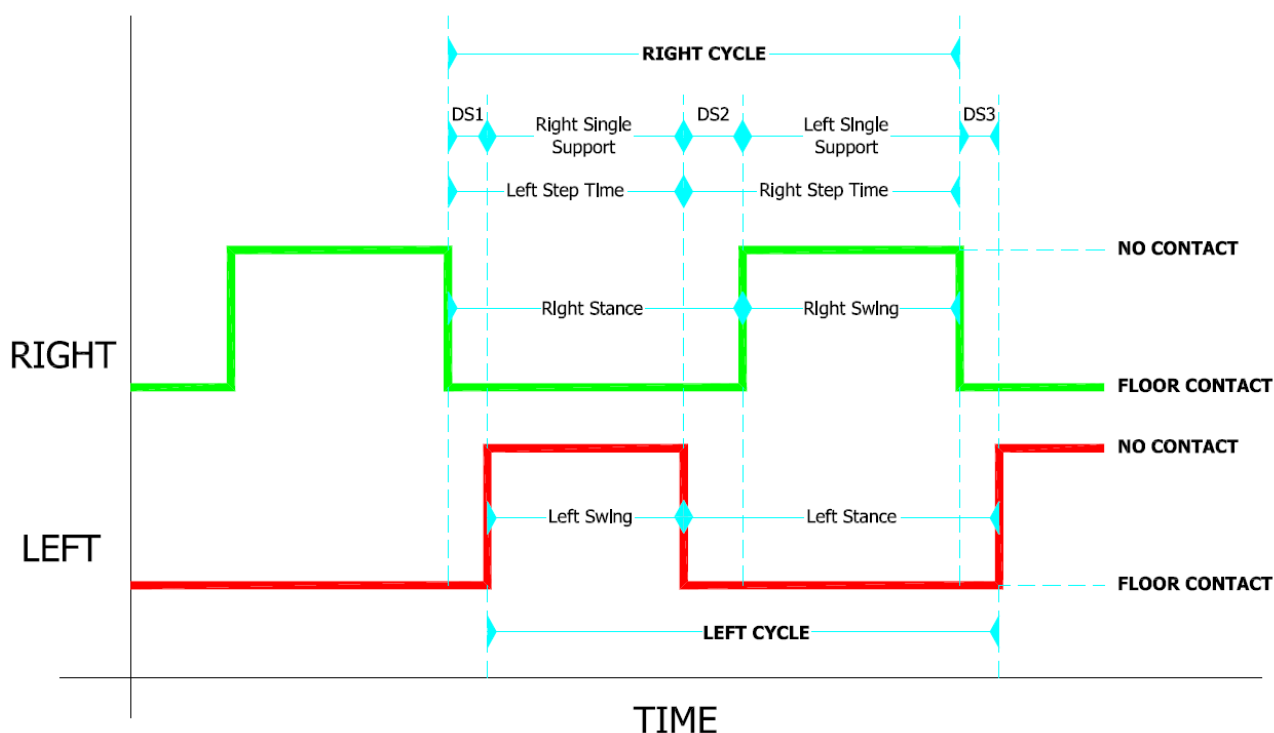


Figure 87 - Gait analysis terminology

The **Gait Cycle** begins when the heel of one foot touches the ground and ends when the same foot, after having executed one step, is set down. The cycle begins with the **Stance** phase (the heel-to-toe contact sequence of the foot) and continues with a **Swing** phase, where the foot is suspended and proceeds in the air (on average the stance phase accounts for 60% and the swing phase for 40%).

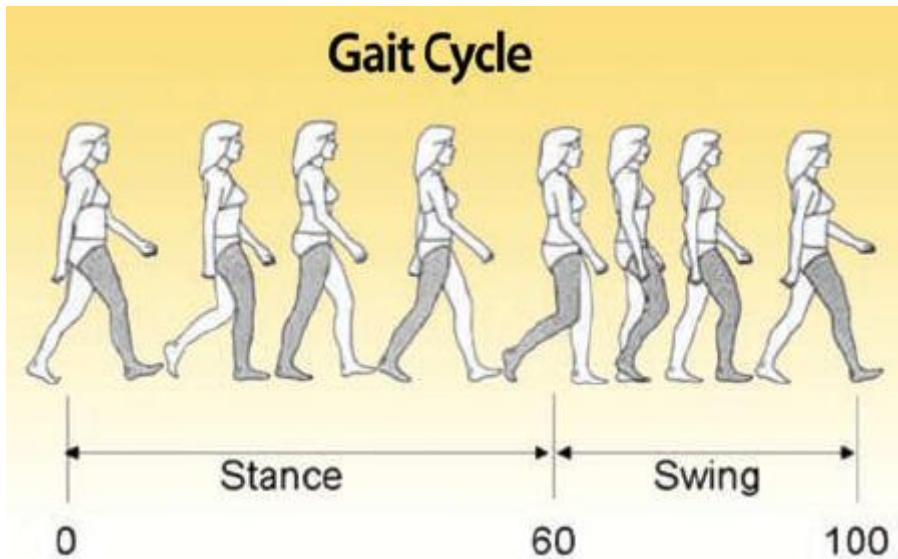


Figure 88 - Gait Cycle: Stance & Swing

Each gait cycle consists of two phases, where both feet are in contact with the ground, called **Double Support**: the first Double Support (DS1 in Figure 87 - **Gait analysis terminology** referred to the right foot) is also called '**Load Response**', whereas the second (DS2) is called '**Pre Swing**'). When only one foot is in contact with the ground, this is called **Single Support**.

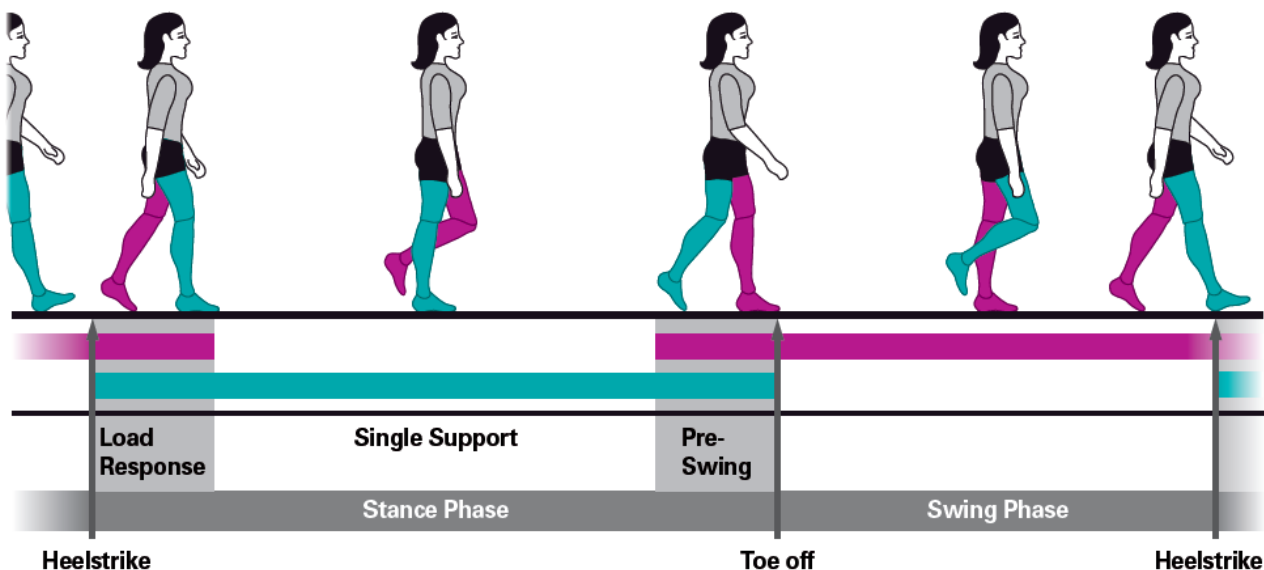


Figure 89 - Stance and Swing Phases

The definitions of **Step** and **Stride** correspond respectively to those of Step and Stride explained in the section above.



### **Run Data Columns**

- **TExt. [s]:** External time: available only for external impulse; this is the time between the event (start/stop) of the impulse and the entry/exit into/from the OptoJump bars; it can also comprise split times
- **Time [s]:** progressive time (split) from the test beginning
- **Distance [cm]:** progressive distance walked/run by an athlete
- **TCont. [s]:** Contact times
- **TFlight [s]:** Flight times
- **Height [cm or in]:** Variation of the center of gravity height during the execution of jumps/runs
- **Speed [m/s or ft/s]:** Average speed of a single step (see Fig. 78)
- **Accelerations [m/s<sup>2</sup> or ft/s<sup>2</sup>]:** Speed variations of the two preceding steps
- **Steps [cm or ft]:** Step length (see definition above)
- **Stride [cm]:** Stride length (see definition above)
- **Pace [step/s]:** Rhythm expressed in steps per second
- **Stride angle [deg]:** Alpha angle of the stride parable
- **Imb. [%]:** imbalance indices of the run between right and left step
- **Double Sup [s.] :** Double Support: Period of time, when both feet touch the ground
- **Step Times [s]:** time between the first contact of one foot and the first contact of the opposite foot
- **Contact Phase [s | %]:** the time between the first contact of the heel and the complete support of the foot; the percentage indicates the value with respect to the total contact time
- **Foot Flat [s | %]:** the time the foot touches completely the ground; the percentage indicates the value with respect to the total contact time
- **Propulsive phase [s | %]:** the time between the lifting of the heel to the complete set off of the tip of the foot; the percentage indicates the value with respect to the total contact time

### **Gait Data Columns**

- **TExt. [s]:** External time: available only for external impulse; this is the time between the event (start/stop) of the impulse and the entry/exit into/from the OptoJump bars; it can also comprise split times
- **Stance phase [s | %]:** The stance phase is the weight phase supporting phase of each gait cycle. It begins with the contact of the heel and finishes with the set off of the tip of the same foot. It is therefore the time between the first and the last contact of two consecutive supports of the same foot. It is also presented as a percentage of the total gait cycle.
- **Swing Phase [s | %]:** The swing phase begins when the tip of the foot leaves the ground and finishes with the contact of the heel. It is therefore the time between the last contact of the first support of the foot and the first contact of the following support. It is expressed in seconds (sec) and as a percentage of the gait cycle of the same foot. The swing time of one foot corresponds to the single support time of the other foot.
- **Single Sup.[s | %]:** Single Support: This is the time between the last contact of the current support and the first contact of the following support of the same foot, i.e. the time when only one foot touches the ground. The single support corresponds to the swing time of the opposite foot. It is expressed in seconds and as a percentage of the total gait cycle time.
- **Total Double Sup [s | %]:** This is the sum of two partial double supports defined DS1 and DS2 in Figure 87 - Gait analysis terminology
- 
- **Step Time [s | %]:** This is the time between the first contact of a foot and the first contact of the opposite foot (it corresponds to the Step Time in the Run Data)
- **Init Double Sup.[s | %]:** This is the first Double Support Time (DS1 in...)
- **Terminal Double Sup. [s | %]:** This is the second Double Support Time (DS2 in...)
- **Step Length [cm]:** Step length (see definition above)
- **Gait cycle [s]:** time between the first contact of two consecutive steps of the same foot
- **Stride Length [cm]:** Stride length (see definition above)
- **Speed [m/s]:** Average speed of a single step (see fig. TODO)
- **Accel. [m/s<sup>2</sup>]:** Speed variations of the two preceding steps
- **Cadence [step/s]:** Rhythm expressed in steps per second
- **Total dist. [cm]:** progressive distance walked/run by an athlete
- **Contact Phase [s | %]:** the time between the first contact of the heel and the complete support of the foot; the percentage indicates the value with respect to the total contact time
- **Foot Flat [s | %]:** the time the foot touches completely the ground; the percentage indicates the value with respect to the total contact time
- **Propulsive phase [s | %]:** the time between the lifting of the heel to the complete set off of the tip of the foot; the percentage indicates the value with respect to the total contact time

## 6.2 INVALID TIMES MANAGEMENT

There are cases where during a test the program may acquire invalid times. The main cases are:

- OptoJump device not installed correctly: if the OptoJump device is badly positioned on the ground, or the ground is particularly uneven, during performance of a test invalid flight or contact times may occur;
- the athlete knocks against the device: if during the test the athlete knocks against the device without however causing it to lose its alignment, this may only temporarily generate some invalid times;
- the athlete exits the measurement area: usually in very long tests it can happen that the athlete exits the measurement area just for one jump and then re-enters the area.

In these cases it may be convenient to keep the test and make a manual/automatic correction to times rather than repeat the test itself.

In fact, the OptoJump program contains an automatic and manual system for managing spurious times acquired during a test. Checking for spurious times is only done on flight, step, and contact times, with any external times always considered as valid.

The basic criterion is that acquired times are always coupled with (contact time) + (flight time or step time). Only at the beginning or end of a test contact, flight or step times without a corresponding contact, flight or step time are possible, because of the start or finish type set in the test.

In the case of a very brief contact, flight or step time, there is an automatic procedure that identifies any invalid times, i.e. below a certain threshold. This threshold can be set or deactivated (see chap. 5.4.1.2)

If there are other errors that are not automatically deleted, it is possible to manually correct them. What to do: select the row with the invalid contact, flight or step time and delete the entire row (and thus the contact-flight time couple). As a result such values will not be considered in the calculation of average values and will not appear in the charts.

In these cases add the contact-flight time couple to the flight time of the previous contact-flight time couple, if it is the contact time that is not average, or add the contact-flight time couple to the contact time of the following contact-flight time couple, if it is the flight time that is not average.

The following chart clarifies this concept:

#### Invalid contact time (delete contact time):

Cont. time	Flight time is	Cont. time	Flight time
0.35	0.43	0.35	0.43
0.30	0.15	0.30	0.45 (0.15+0.05+0.25)
0.05 (inval.)	0.25		
0.32	0.41	0.32	0.41

#### Invalid flight time (delete flight time):

Cont. time	Flight time is	Cont. time	Flight time
0.35	0.43	0.35	0.43
0.10	0.05 (inval.)		
0.15	0.42	0.30(0.10+0.05+0.15)	0.42
0.32	0.41	0.32	0.41

The command 'Show marked rows', accessible from the Row Management Menu (see chap.5.3.1.3.1) allows then to remove the deleted rows from the view (and only from the view) in order to analyze only the data of interest.

Note: if the OptoJump device is not installed correctly and consequently generates spurious times during a test, it is however better for the user to correct the installation of the device to eliminate spurious times beforehand rather than to filter invalid times afterwards. Correct installation can be checked using the OptoJump bars Test (see chap. 5.4.3).

## 6.3 VIDEO ANALYSIS



Figure 90 – Video Analysis

To analyze a still video picture, just double-click with the mouse on the video window. In a Compare analysis or in a test, where two webcams are used, use CTRL+double-click to edit the two images.

Available commands are the following, from top to bottom:

- Delete all
- Load an image stored on disk
- Save the image on disk in .BMP format
- Save the image in the report; you will be asked to name the image, which will be appended at the end of the report
- Save the added graphical elements (grids, rows, angles, texts, etc.) as overlay in the video;
- Delete the items added with the previous command as overlay of the video
- Select items. To select more than one item keep CTRL pressed
- Pan: Moves all added items
- Move: Moves the selected item
- Undo
- Redo
- Set the current color
- Set the font and other text features
- Draw a grid with the set features on the image
- Sample ruler: allows to set a known length (e.g. the height of a step)
- Draw single line
- Draw connected lines (ESC to close the drawing)
- Draw circumference through two points

- Draw center-radius circumference
- Draw two-point arc
- Draw center-radius arc
- Draw three-point arc (Start / End / Include)
- Draw three-point arc (Start / Include / End)
- Draw lines viewing internal angle
- Draw lines viewing external angle
- Text tool
- Line with measure: draw a line with length indication calculated after having used the tool Measurement Ruler. WARNING: the measurement must be made on the same level of the item measured before. e.g. have the athlete stand sideways to a step of a known height, use the tool 'Sample Ruler' to measure the step, then measure the athlete with this tool.

To exit press the EXIT symbol at the end of the tool bar.

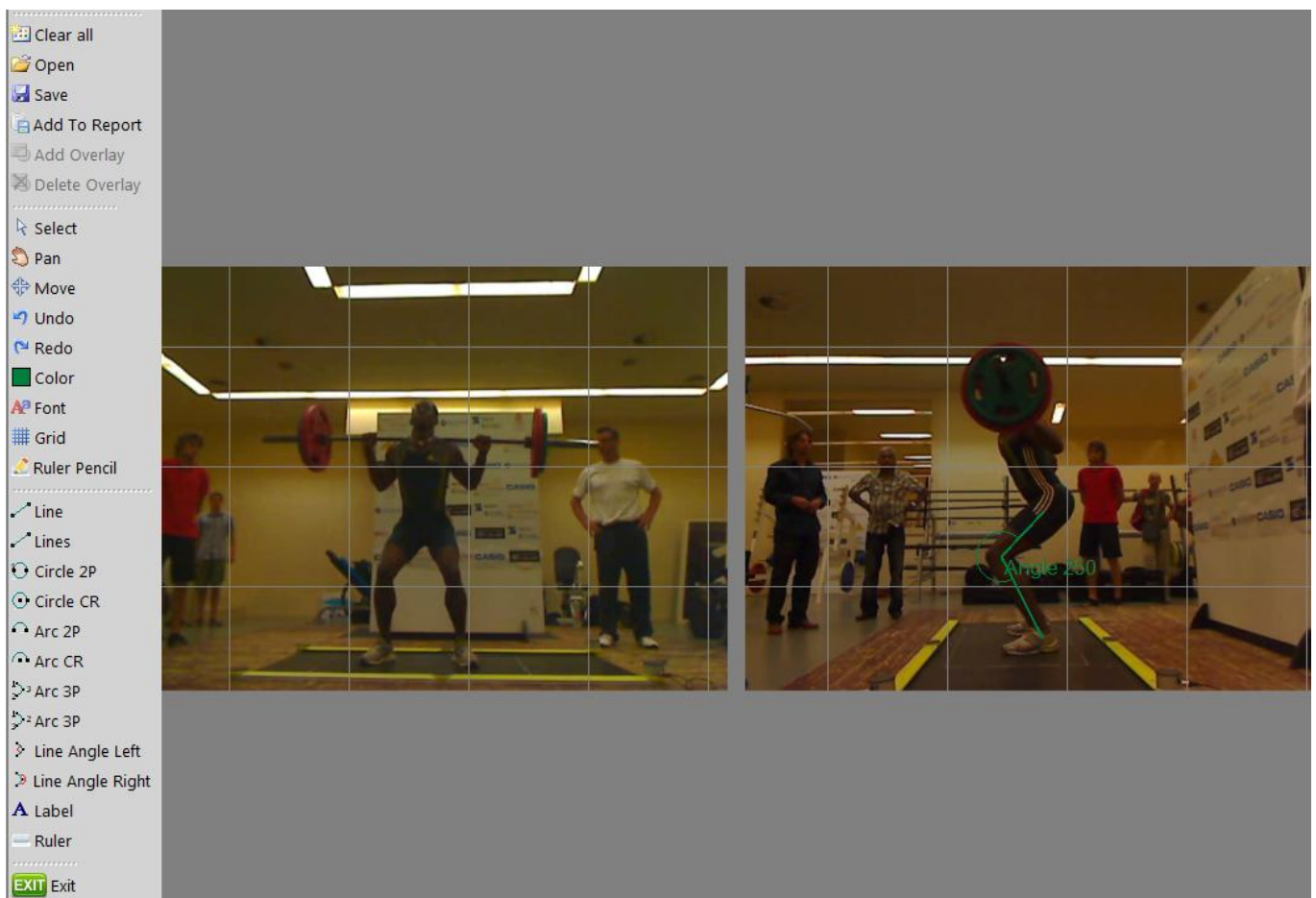


Figura 91 - Toolbar and double image under analysis

## 7 APPENDIX A – OPTOJUMP NEXT BATTERY LIFE

Bars	1	2	3	4	5	6	7	8	9	10
Theoretical Tx96	11.54	5.88	3.93	2.88	2.27	1.86	1.57	1.34	1.14	1.02
Theoretical Rx96	14.40	7.89	5.39	4.11	3.25	2.69	2.28	2.00	1.74	1.55

Table 2 - Battery life expressed in hours



## 8 APPENDIX B – DATABASE AND VIDEO

The OptoJump Next program is based on an SQL Server Compact 3.5 Desktop database. The database is a file where all OptoJump Next data is stored. A number of database files can be created for particular purposes. For example, two databases could be created, one for managing the players on a soccer team, the other for an athletics team. For operations available on the databases see chap. 5.4.4

When the software is started the first time, the program creates an empty database and saves it in the local %appdata% folder.

The address of this hidden folder can be retrieved from the OptoJump Next program in the 'Database' panel (see chap. 5.4.4)

If there is an error when loading the database, OptoJump Next notifies it at program startup, suggesting to look for the database or to continue. In the latter case, OptoJump Next creates a new empty database.

The **videos** are located in the database folder in the subfolder 'Videos'.

The name of the videos is formed using the following pattern:

VideoX\_DD\_MM\_YYYY\_HH\_MM\_SS\_ZZZZZZZZ-ZZZZ-ZZZZ-ZZZZ-ZZZZZZZZZZZ.EEE

Where

- X: webcam No. 1 or No. 2
- DD\_MM\_YYYY: day, month and year of acquisition
- HH\_MM\_SS: hour, minutes and seconds of acquisition
- ZZZZZZZZ-ZZZZ-ZZZZ-ZZZZ-ZZZZZZZZZZZ series of univocal characters to avoid duplicates
- EEE: video format (ASF or AVI)

Example:

Video1\_02\_04\_2009\_12\_32\_16\_1f74d384-4a7f-4c5b-a94c-1772fb608736.asf

Meaning

Video taken by webcam No. 1 on 2/4/2009 at 12:32:16 in ASF format

The **images** (analyzed still frames) saved using the command 'Save images in report' are located in the subdirectory Images and have the following similar format:

VideoX\_DD\_MM\_YYYY\_HH\_MM\_SS\_ZZZZZZZZ-ZZZZ-ZZZZ-ZZZZ-ZZZZZZZZZZZ.EEE

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